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ABSTRACT

This document is one example of a Selected Mathematics Applications (Level B) course. According to the Hawaii State Department of Education's guidelines, a Level B course has learner objectives that are designed to maintain and extend a student's basic skills through applications of mathematics in a variety of "real-life" situations. The focus of this course is on problem solving skills and their application to topics in metric measurement and statistics. This sample course consists of two parts. Part one discusses the approach used to develop this course and provides a brief description of alternative materials and resources. Part two presents an overview of the program and a detailed teacher commentary with emphasis on a problem solving approach to statistics and metric measurement. Masters for fact and worksheets and quizzes and a unit test designed to fit the outlined teaching guide are provided. (MP)

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# Applying Problem Solving to STATISTICS and the METRIC SYSTEM

SE 034 608

Office of Instructional Services/General Education Branch • Department of Education • State of Hawaii • RS 80-7304 • June 1980

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# INTRODUCTION

The Authorized Courses and Code Numbers 1980-1981 lists seven code numbers for Selected Mathematics Applications (Level B) courses. Each semester course utilizes different application areas to address some or all of the Level B Learner Objectives listed in the Mathematics Program Guide.

Applying Problem Solving to Statistics and the Metric System is one example of a Selected Mathematics Applications (Level B) course. This sample course consists of two parts. Part I discusses the approach used to develop this course and provides a brief description of alternative materials and resources. Part II presents an overview of the course and a detailed teacher commentary with emphasis on a problem-solving approach to statistics and metric measurement.

## PART I: APPROACH AND ALTERNATIVES

According to the Department of Education's Mathematics Program Guide 7-12 (MPG), a Level B course is designed to maintain and extend a student's basic skills through applications of mathematics in a variety of "real-life" situations. The MPG lists sixteen Learner Objectives for Level B courses.

There are several approaches to developing a Level B course. One is to cover all sixteen objectives in one semester. Such a course could be developed for those students who need only a brief review of these objectives. However, as this approach would involve skimming each objective it would not be appropriate for many students with specific deficiencies at this level. Recently published texts for general mathematics classes, with an emphasis on applications, may be adapted for this approach.

Another approach is to design a course around a specific career or interest, addressing those objectives that are related to the specialized studies in that area. Examples of this type of Level B course include: Industrial Mathematics or Technical Mathematics. High schools that adopted the Pre-Industrial Preparation (PIP) program have developed course guides for these courses. The high schools include Waialua, Kalani, and Farrington.

The third approach is to concentrate on applications that emphasize clusters of these Level B Learner Objectives. Applying Problem Solving to Statistics and the Metric System uses this approach. Its major focus is the application of problem-solving strategies to the study of statistics and the metric system. This approach reflects the belief that problem solving should be taught in a content area rather than as a separate unit. Unfortunately, appropriate materials in which problem solving is interwoven in these content areas could not be located. Moreover, only a limited number of materials that reflected the applications focus of an Option X course are available. A brief description of these materials covering statistics and metric measurement is included below. Some of these are student materials; others are teacher resource materials.

STATISTICS:

Johnson, et al. Sampling and Statistics. Glenview: Scott, Foresman, 1972.

Sampling and Statistics is one unit of a course that was designed for the ninth grade pre-algebra or general mathematics student. It incorporates real-life applications and the use of manipulatives throughout its eleven lessons. Each lesson is not one class period but a topic, such as sampling techniques, reading and drawing graphs, or finding the mean.

In addition to the student text, the publisher provides a teacher's edition and a booklet of duplicating masters and overhead visuals.

Mathematics Resource Project. Statistics and Information Organization (Preliminary Edition). Palo Alto, CA: Creative Publications, 1977.

Statistics and Information Organization, part of the Mathematics Resource Project, is one of five teacher resource books developed by the University of Oregon. It includes a teacher commentary as well as classroom materials. The teacher commentary provides readings on the rationale for teaching the topic, ways to involve students, and alternate ways to introduce or develop topics. The classroom materials include masters for worksheets and transparencies, lab cards and activities, games, bulletin board suggestions, and teacher-directed activities.

There are a number of appropriate readings for the teacher and suggestions for classroom activities. While the materials are geared for grades five to nine, many of the activities may be used to supplement a Level B unit in statistics.

Mosteller, F. et al.(Ed.). Statistics by Example: Exploring Data. Menlo Park, CA: Addison-Wesley, 1973.

Statistics by Example has four parts subtitled Exploring Data, Weighing Chances, Detecting Patterns, and Finding Models. These pamphlets were prepared and edited by the Joint Committee on the Curriculum in Statistics and Probability of the American Statistical Association and the National Council of Teachers of Mathematics.

While these pamphlets are more appropriate for an Option Y statistics course, Exploring Data contains a few projects that could be modified for the better students in a Level B course. These projects require students to read examples of an application of statistics, complete exercises related to the readings, and conduct an independent investigation on a suggested topic. Appropriate examples include "Tom Paine and Social Security," "The Cost of Eating," and "Organizing and Reading Population Data."

National Council of Teachers of Mathematics. Booklet 16: Collecting, Organizing, and Interpreting Data in Topics in Mathematics Series. Washington, D.C.: National Council of Teachers of Mathematics, 1969.

Collecting, Organizing, and Interpreting Data is a teacher resource providing a discussion of key concepts in statistics. This booklet may also be found in the Thirtieth Yearbook of the National Council of Teachers of Mathematics.

The booklet addresses the role and application of statistical methods in the analysis of problem situations in which decisions must be made with limited information. Examples and exercises that reflect the many applications of statistics are provided. In addition, a section relating the four stages generally associated with problem solving to statistical procedures is included (see Mathematics Program Guide, pages 16-17).

Forthcoming: 1981 National Council of Teachers of Mathematics Yearbook on statistics and the teaching of statistics.

Articles will provide strategies for teaching statistics as well as exercises for students. Additional references will be included.

METRIC:

Averett, D., Crump, B., & Rosenbaum, G. Think Metric, Level Green. New York: William H. Sadlier, 1976.

Think Metric, Level Green is the last book in a series of three workbooks to teach the metric system via a "hands-on approach." It includes the following topics: measures of length, area, capacity, mass (weight), time, and temperature, and applications of these measurements.

Activities for students involve estimation and measurement in metric units, computation involving decimals, and conversions within the metric system. A glossary of metric terms is included.

While the publisher suggests that Think Metric can be used for grades six to nine, the format and the activities are appropriate for high school students. A number of applications and extensions are suggested in the teacher's edition.

Bright, G., & Thacker, M. Activities to Go Metric, Booklet C. Glenview: Scott, Foresman, 1975.

Activities to Go Metric, Booklet C consists of three parts. Since certain topics such as linear measure and area are found in more than one of these parts, the teacher will need to select those activities that are most appropriate. The teacher's guide suggests that the activities in Part 3 be used to supplement activities in Parts 1 and 2.

The topics include linear measure, area, volume, and weight. In addition to the activities related to estimation, measurement, and conversion within the metric system, a few formulas for area and volume are provided.

Hawaii State Department of Education. Learning About the Metric System in High School. Honolulu: Hawaii State Department of Education, 1978.

Learning About the Metric System in High School uses an activity-oriented approach to help students become familiar with the metric system. It was developed by the Curriculum Research and Development Group of the University of Hawaii and pilot tested at Kailua High School.

This workbook covers topics in length, area, volume, capacity, mass, temperature and conversions within metric units. The activities, games, and exercises in this five-week unit utilize many manipulatives. Since it was developed locally, the illustrations, maps, and problems reflect the Hawaiian environment and culture.

May, L., & Jacobs, D. Measure Metric, Book D. New York: Harcourt Brace and Jovanovich, 1974.

Measure Metric, Book D is the last book in a series of four workbooks. It provides activities that are designed to help students learn the metric measures of length, area, volume, capacity, mass, and temperature. The student learns the metric system by actively measuring and estimating. Computation involving decimals and conversions within the metric system are also included.

The publisher suggests that Measure Metric, Book D be used in grades six through eight. While the activities are appropriate for high school students, the cartoons may be too elementary for this level.

O'Daffer, P., & Clemens, S. Metric Measurement for Teachers: An Activity Approach. Menlo Park: Addison-Wesley, 1976.

Metric Measurement for Teachers: An Activity Approach is a teacher resource that describes an activities approach to learning the metric system of measurement. It suggests a number of investigations and activities that require students to estimate and measure properties of familiar objects. Many of these activities are presented in a format that may be made into a worksheet for students. In addition, paper and pencil exercises requiring students to choose a reasonable answer, to convert within the metric system, and to solve word problems involving metric units are included. These investigations, activities, and exercises may be used to supplement and enrich any unit on the metric system.

This booklet provides a sufficient number of investigations, activities, and exercises to be used as a basis for a course in metric measurement. However, as this is a teacher resource, all student materials will have to be duplicated.

Whitman, N., & Braun, F. The Metric System: A Laboratory Approach for Teachers. New York: Wiley & Sons, 1978.

As the title suggests, this book provides a laboratory approach to teaching and learning the metric system. While the book was written for elementary school teachers, many of the activities involving direct measurement and estimation can be easily adapted for use in a high school classroom. The activities involve using the metric units for length, area, volume, capacity, mass, and temperature.

In addition to these chapters on activities, the book provides features for teachers. These include a section on the history of the metric system, considerations related to child development and learning, suggestions for classroom management when using a laboratory approach, and a list of commercially available instructional aids and teacher resources.

PART II: APPLYING PROBLEM SOLVING TO STATISTICS AND THE METRIC SYSTEM--
A SAMPLE COURSE

## Course Overview

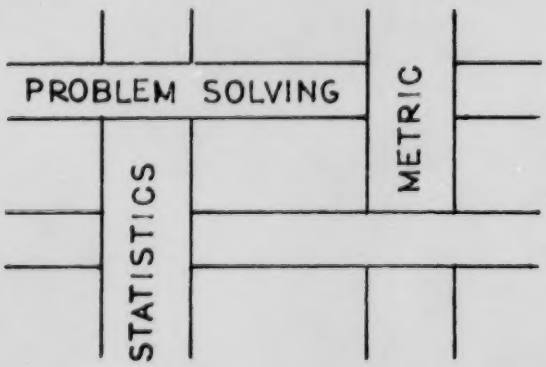
As the title suggests, Applying Problem Solving to Statistics and the Metric System focuses on the application of problem-solving strategies to the study of statistics and metric measurement. Consequently, emphasis and time is provided for the teaching of problem-solving skills and their application to topics in statistics and metric measurement. Therefore, this course really has three components: the statistics unit, the metric unit, and a third "unit" on problem solving that is interwoven throughout the course.

The focus on problem solving reflects the Department of Education's emphasis on developing these skills. Providing experiences that enable students to develop problem-solving skills is a goal stated in both the Foundation Program Objectives and the Mathematics Program Guide (MPG). A discussion of the role of problem solving in the mathematics curriculum is found on pages 15-23 in the MPG.

In addition to the goals for developing problem-solving skills, this course includes the following Learner Objectives listed in the MPG for a Level B course:

1. Solves ratio, proportion, and percent problems. (Statistics)
2. Understands and uses the relationship among common fractions, decimals, and percents. (Statistics, Metric)
3. Applies concepts of length, perimeter, area, volume and angle measurement. (Metric)
4. Makes measurements using both customary and metric units. (Metric)
5. Changes units with the metric system. (Metric)
6. Prepares and interprets simple statistically oriented graphs. (Statistics)
7. Collects and organizes numerical data. (Statistics)
8. Makes decisions after interpreting data. (Statistics)

The sketch below illustrates the components of Applying Problem Solving to Statistics and the Metric System:



Applying Problem Solving to Statistics and the Metric System*

Course Outline

I. Statistics

A. Review of proportions, decimals, percents

B. Definition and uses of statistics

C. Collecting and organizing data

1. Surveys

2. Random sampling

3. Frequency distribution

D. Statistics in newspapers and periodicals

E. Interpreting and constructing graphs

F. Measures of central tendency

1. Median

2. Mode

3. Mean

G. Ranking within a population

II. Metric System

A. Decimal review

B. Length

C. Area

D. Volume

E. Capacity

F. Mass

G. Temperature

Estimating and measuring activities involving common metric units are incorporated throughout this unit. Conversion within the metric system help to maintain computational skill with decimals.

*Problem-solving strategies are incorporated throughout this course. Applications of these strategies to specific topics are highlighted in the teacher commentary.

## Problem-Solving Component

The development of problem-solving skills is one of the eight Foundation Program Objectives adopted by the Department of Education. As such, it must be considered one of the "basic skills" that each student should develop.

Problem solving in this context refers to finding an appropriate response to a new situation or to a question which does not have an obvious answer; that is, getting the answer involves more than an act of simple memory or the application of a familiar algorithm. The problem solver must analyze the situation and determine the best strategy among a choice of many.

Problem-solving skills do not necessarily result incidentally from exposure. Rather, these strategies should be taught for maximum results. The attitude of the teacher toward problem solving is an important factor. Some teaching suggestions for problem solving are:

1) To encourage discussion of problems and alternatives. This is the key to the course. Every problem can be expanded if students indicate an interest.

2) To ask leading questions instead of giving answers. What would happen if...? Suppose we change...?

3) To emphasize and provide the time needed for thinking about the problem. True problem solving requires time to think. If the "answer" is obvious, then there was no problem.

4) To emphasize the process or strategies involved. In this course, the goal is to think through a problem. Finding a solution to the problem is just one result of this thought process. These problem-solving techniques are applicable in many areas.

5) To find problem solving a fun, challenging and rewarding experience for yourself and your students.

Teacher directed discussion is an important aspect of this course. Discussion gives students the opportunity to develop language and communication skills. For example, vocabulary can be expanded when unfamiliar words are defined. Also, teachers gain insights into how a student thinks when the student describes strategies used or patterns observed in a problem.

Specific activities and suggestions for highlighting problem-solving strategies are provided for each Lesson in the commentary under Problem-Solving Emphases. In addition, specific problem-solving behaviors are included between the double arrows, ≪.....≫, in the left margin.

In addition, an evaluation form, Problem Solving Evaluation Check List, is included on page B9 to help the teacher assess student progress in problem solving. While the assessment is somewhat subjective, it should help to record student progress through the course.

Problem Solving Evaluation Check List*
High School

Course in which Evaluation Occurs: _____

Date of Evaluation: _____

1. Most students are capable of working problems at about what level?

2. Evaluate students' enjoyment of problem solving as good, fair, or poor.

3. Evaluate students' perseverance in problem solving as good, fair, or poor.

4. Have you seen students spontaneously use these problem-solving techniques?

   a. Reads the problem carefully; makes an effort to understand problem

   b. Looks for patterns

   c. Organizes, makes a table

   d. Simplifies the problem or works on part of the problem

   e. Writes a mathematical sentence

   f. Guesses, checks, tries new approaches when stuck

   g. Recognizes absurd or illogical answers

   h. Draws a diagram

   i. Acts out the problem

   j. Extends the problem

5. Other problem-solving behaviors observed.**

* Adopted from Mathematics Instruction in the Elementary Grades, by McKellys, W. D., et al.

** See Mathematics Program Guide, pp. 16-17.

UNIT I - STATISTICS

## DESCRIPTION OF STATISTICS UNIT

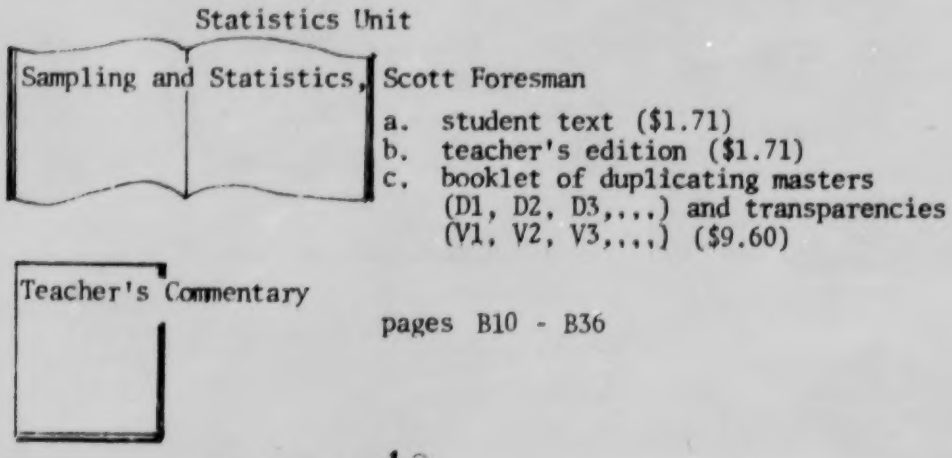
Statistics may be defined as a branch of mathematics dealing with the collection, analysis, interpretation and presentation of numerical information. With technological advances, statistics is playing an ever increasing role in today's society. The public encounters more and more statistics in the mass media everyday. To function effectively in our society, knowledge of some simple statistical methods to analyze information is becoming a necessary skill.

In this unit students learn some of the considerations that influence the type and size of samples, the ways in which information may be organized and presented, and the kinds of interpretations that can be made from the same data. Through these activities the student should become aware that statistics is not an exact science. These lessons provide ample opportunity for the incorporation of problem solving strategies. These strategies are described in the teacher commentary under Problem-Solving Emphases. It includes specific activities and teaching suggestions. In addition, specific problem-solving skills are flagged out between double arrows, ≪...≫, in the left-hand margin.

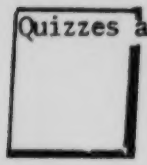
This unit is based on the booklet, Sampling and Statistics by Johnson, et al., published by Scott, Foresman and Company. There are eleven lessons in this booklet. Lessons 1-3 cover surveys and sampling. Students learn to make frequency tables, and use ratio and percent to make comparisons. Lesson 4 looks at statistical data in the newspapers and provides further practice with ratios, proportion and percent. Students learn to read, interpret and make various types of graphs in lessons 5-7. The remainder of the lessons cover the basic measures of central tendency (mean, median, mode), range, and ranking. Students learn to find each measure as well as determine the most appropriate measure for a given situation.

In addition to the student text, a teacher's edition and a booklet of duplicating masters and transparencies are available from the publisher. These are incorporated in this course.

The diagram below displays the major elements of this unit:


Statistics Unit
Sampling and Statistics, Scott Foresman
a. student text ($1.71)
b. teacher's edition ($1.71)
c. booklet of duplicating masters (D1, D2, D3,...) and transparencies (V1, V2, V3,...) ($9.60)
Teacher's Commentary
pages B10 - B36

Masters for Worksheets and Transparencies
pages B61 - B86



Quizzes and Tests
pages B91 - B99

## RELATED PROBLEM-SOLVING BEHAVIORS

The following may be used as a teacher reference or as a basis for a class discussion. Resulting ideas can be added to this list of problem-solving behaviors that can be applied to the study of statistics.

1. Understanding the Problem

   --restate the problem
   --determine what is known
   --clarify the vocabulary, conditions, limits of the problem
   --determine the nature of the answer (e.g., how accurate?)

2. Devising a Plan

   --determine what information is needed
   --determine how information is to be obtained
   --look at alternative strategies and/or approaches
   --consider the consequences of each alternative

3. Carrying Out the Plan

   --collect data
   --organize data into tables or graphs (How is data best represented? Can data be easily and accurately read and interpreted?)
   --summarize and interpret data

4. Looking Back

   --Was the plan a good one?
   --Is the interpretation justified?
   --Is the result reasonable and/or accurate?
   --Has the problem been solved? The question answered?
   --Are there further implications?
   --Are there noticeable trends or patterns?
   --Can the information be used for forecasting?

The teacher's edition of Sampling and Statistics provides a section called Lesson Notes that include objectives, materials, and notes for each lesson in the text (pages T1 to T12). These notes point out ideas that should be emphasized in class discussion. A lesson in the text is not the equivalent of one class period. Rather, each lesson covers a topic that may take one week to complete.

A commentary of activities and suggestions for highlighting problem-solving strategies is provided below for each lesson. Additional objectives and materials are also included in the commentary.

This unit begins with a brief review of ratios and percents. The review uses worksheets that are provided by the publisher as well as those developed by the project.

The teacher is encouraged to keep a log of the daily lessons on the space provided next to the outline. Questions, such as "How can I teach this better the next time?", "Were materials sufficient?", "Is the activity more successful working in pairs or individually?", "Can I extend the lesson for the faster students?", etc., can be answered in the daily log.

| Reminder: | Page Label | Where Found |
|---|---|---|
| | D1, D2, D3,... | Duplicating Masters (from Scott Foresman) |
| | V1, V2, V3,... | Overhead visuals (from Scott Foresman) |
| | B12 - B36 | Teacher Commentary (from project) |
| | B61 - B86 | Masters for Worksheets and Transparencies (from project) |
| | B91 - B99 | Masters for quizzes and tests (from project) |

Ratio and Percent Review

Objectives: To change a ratio to a percent and a percent to a ratio.
To round to the nearest whole number percent.
To compare ratios by converting to percents.
To investigate the uses of ratios and percents in newspapers and magazines.

Materials: Have students bring in examples of ratios and percents found in newspapers and magazines.

Ratio and Percent Worksheets
a. Ratio and Percent Review I, II, III, pages B61, B62, B63
b. D2 and D3 (in booklet of duplicating masters from Scott Foresman)
c. Comparing Ratios, page B64

Graph paper

Comments: You may want to begin the unit by having students bring in examples from ads: 25%

off sale, 4 out of 5 doctors recommend..., 4% sales tax added, etc.

Discussion on these will help you determine what students know about ratios and percents, as well as what some of their misconceptions could be. You may want to point out the widespread application of ratios, percents and statistics in general as a possible reason for studying them in school.

D2 and D3 use the cross product method to convert a ratio to a percent. However, you may want to use your own technique with your class. If you choose to use your own method, you will need to remind students to ignore future references to the cross product method in the duplicating masters provided by the publisher.

Problem solving emphases:

Ratio and Percent Review I, page B61

≪BREAK PROBLEM INTO PARTS≫

≪LOOK FOR PATTERNS≫

≪MAKE AND VERIFY CONJECTURE≫

≪DRAW A DIAGRAM≫

You will need to include a discussion of methods for solving problems such as #8, #10, and #12. One way is to break the problem into parts. For example, to understand the ratio 6 out of 8, ask students to shade 6 out of every 8 squares on the grid until there are only 4 squares left. Ask students to study the pattern in the ratio 6 out of 8 and make a conjecture about ___ out of 4. Ask for a justification that 3 out of 4 is reasonable. One argument is that 3 out of 4 twice gives 6 out of 8, which can be demonstrated on the grid.

Have students use graph paper to sketch out problems. An example is provided. Students who need to sketch out problems on subsequent worksheets should be encouraged to do so.

Ratio and Percent Review II, page B62

Ask students to point out any patterns that they see. Some of them are:

10% means 10 out of every 100

÷ 2 ↓ 5 out of every 50 ÷ 2

÷ 5 ↓ 1 out of every 10 ÷ 5

x 9 ↓ 9 out of every ___ x 9

↓ ___ out of every ___

So, 10% of 100 is ____
10% of 50 is ____
10% of ____ is 9
10% of ____ is ____

from last column ↗ ↖ from first column

«LOOKING BACK»

«DISCUSSION FOR INSIGHT»

After completing this worksheet, have students share "shortcuts" to solving these problems. The methods may include dividing/multiplying by the same number, or after finding 1 out of every ___, to multiply by the appropriate number.

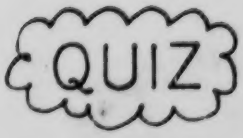
Another activity involves asking students for applications of these statements. For example, 25% of 20 is 5: A shirt costs $20. During a 25% off sale, the discount will be $5. Have students make up story problems for similar statements.

«APPLY PROCESS USED TO SOLVE SIMILAR PROBLEMS»

Note: Most students have not had practice in making up their own story to fit a mathematical statement. Initially you may have to help them get started by providing the first part of the story and having students complete it to fit the statement.

Comparing Ratios, page B64

Be sure to discuss "To the student" at the top of this worksheet. Elicit other examples from students.




Following completion of these six worksheets, Quiz 1 should be administered.

Problem-Solving Introduction

Objectives: To recognize facts that are given in a problem.
To determine what new information can be derived from given facts.
To derive new information by using tables and diagrams.

Materials: Identifying Facts, pages B65-B66
Relating Facts, pages B67-B68
Relating Facts Logically, pages B69-B70

Problem-solving emphases:

Identifying Facts, pages B65-B66

≪STATE THE CONDITIONS OF THE PROBLEM≫

Note that students are not asked to solve the word problem.

Do not ask them to do the computation at this point. Instead, discuss

≪CLARIFY MEANING OF TERMS≫

a. vocabulary such as average (problem #1), rectangle, perimeter (problem #2), grams (problem #4), 15% of (problem #5).

≪READING TABLES≫

b. how to read tables (problem #7). Ask students where to find the sales tax deduction for an income of $9,217.

Relating Facts, pages B67-B68

Encourage students to ask questions about vocabulary and formats they do not understand. You may need to discuss the time card and how to read it (problem #5). In problem #6, students may not be familiar with the temperature report (what does the first column of numbers stand for?).

≪MAKE A DIAGRAM OR A MODEL≫

A diagram or cards with Dave, Jack, and Jerry printed on them will help solve problem #1.

≪BRAINSTORM≫

During the discussion you may ask students what other facts can be derived.

Relating Facts Logically, pages B69-B70

≪LIST ALL INFORMATION GIVEN≫

Students will probably need directions on filling in the tables and diagrams. One suggestion for the tables is to place an "X" to indicate a definite "no" and a dot, "•" to indicate a definite "yes." Once you determine a definite "yes," place an "X" in all the other boxes in the row and column that contain the dot.

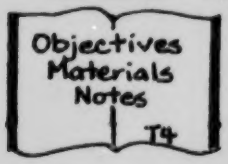
≪LIST RELATED FACTS≫

A sample problem is provided on page B71. It is ready to be made into a transparency. Discuss possibilities with your class before assigning pages B69-B70.

≪USE AND PURPOSE OF TABLES≫

Question #5 is difficult and is intended for discussion in class. Students may become frustrated if this is assigned for homework.

Pages 1 to 4 Lesson 1: Finding New Facts




Read page T4 of teacher's edition of Sampling and Statistics.

Additional materials:
The 1980 Census, pages B72-B73

Problem-solving emphases:
The 1980 Census, page B72, can be made into a transparency or a handout for students and used as a basis for class discussion. Samples of vocabulary and statistical methods are noted on page B73 to help begin the discussion. For example, ask students what they think decennial means in the sixth paragraph. If necessary, point students to the preceding paragraph for a hint. Try to elicit student responses as class discussion is important in this course.

≪CLARIFY VOCABULARY≫

To help students learn to read the language of mathematics that is found in newspapers and magazines, ask students to bring in articles with the mathematical and statistical terms underlined.

≪APPLY PROCESS TO SOLVE SIMILAR PROBLEMS≫

Use strategies learned in Relating Facts Logically (pages B69-B70) to bridge into organizing results of a survey in a table. The table will help students in their analysis of what information was collected and how that information may be interpreted.

≪LOOK AT SIMILAR PROBLEM SOLVED BEFORE≫

Duplicating Master D1 may be used for tables 1, 2, and 3, if you prefer that students not write in the book. Recall with the class that in order to compare ratios you need the same base, and percents provide a convenient (and commonly used) basis for comparison.

≪ANALYSIS OF TABLE: MAKE DEDUCTIONS≫

Discuss how the organization of data in a frequency table provides a way to pick out certain facts readily;

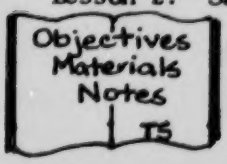
«INTERPRET DATA»

1. How many different items (sports or numbers) were selected by people surveyed?
2. What is the most popular (sport, number, etc.)?
3. What is the least popular (sport, number, etc.)?

«LOOKING BACK»

Discuss possible reasons for the results for different groups (see questions 17 and 18, page 3). Other questions include: Could data be biased? Is there sufficient data to make a conclusion?

Pages 6 to 9 Lesson 2: Sampling in Card Games




Read page T5 of teacher's edition of Sampling and Statistics.

Additional materials:
Dealing Pairs, page B74
Playing cards (optional)

Additional comments:
This lesson is activity-oriented. Be sure that you have demonstrated the procedures for the experiments before students break into groups.

If you choose not to use playing cards, you may use the cards from punchout 45. Use the numbers 1-13 from 4 sets to get the equivalent of a deck of playing cards. Another alternative is to use 4 different colored index cards. You will need thirteen of each color. For each color, write the numbers 2-10, and the letters J, Q, K, A to get the equivalent of a deck of playing cards.

Reminder: Groups that complete their work early may be asked to help you cut 1" square pieces of paper required for Lesson 3.

Problem-solving emphases:

«UNDERSTANDING THE PROBLEM: CLARIFY TERMS»

Define and discuss what is meant by a random sample. Random sample is based on the idea that every number of a collection has an equally likely chance of being chosen.



Oct 20

≪GO BACK TO DEFINITION≫

Establish criteria for a random sample by class discussion. Have students provide examples of a random sample and check the example against the established criteria. Some examples are shuffling a deck of cards, tossing a fair coin, mixing colored paper or balls for a lottery, and the use of a random number table.

≪MAKE A PHYSICAL MODEL≫

In Dealing Pairs, ask the class what "at least one pair" means. Example: Does a hand made up of 2, 2, 7, 7, 9 require one or two tallies? How many hand(s) is this?

Also, remind students to shuffle well after each experiment in order to maintain randomness. Pairs should be separated before being replaced in the deck.

Before assigning pages 6 - 9, be sure to discuss vocabulary: 1) odd number, 2) even number, 3) divisible by __.

≪CLARIFY VOCABULARY≫

One way to begin the discussion is to point out what these words do not mean in this context by contrasting them to uses such as "an odd shape" or "get even." Within the context of mathematics, ask students to provide examples of odd numbers (e.g., 1, 3, 5, 117), examples that are not odd numbers (e.g., 10, 1/2, .24), and explain their response. These should be written on the board in an organized list.

≪MAKE AN ORGANIZED LIST≫

≪LOOKING BACK≫

In examining results of the experiments, class discussion could begin with questions such as:

1) Did you really have a random sample? How was the collection made up? Did you really shuffle your cards well after each experiment? How large was your sample? Did each member of the collection have an equal chance of being selected?

≪EXTEND THE PROBLEM≫

2) What consequence would you expect if pairs were returned to the deck without being separated?

3) Can you think of examples of how sampling is used in public opinion polls, government, or stores? Have you ever been interviewed or asked to complete a questionnaire?

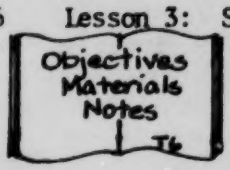
«APPLICATION TO "REAL-LIFE" SITUATION»

4) Describe examples where you used sampling. Examples include: deciding which supermarket to shop at, which restaurant to patronize, etc.

Other activities:

Students may make their own known collection of cards, colored pieces of paper cut into 1" squares, or centimeter cubes of different colors. Others in the class can try to determine the composition of the total collection by sampling. Problems that may be investigated include: how close the distribution of the sample is to the total population and how to determine the sample size needed to achieve results that are close to the total population.

Pages 11 to 16 Lesson 3: Statistics from Samples




Read page T6 of teacher's edition of Sampling and Statistics.

Additional materials:

Collection of 1" square pieces of paper in three colors (minimum of 200 pieces with a breakdown of 50%, 30%, and 20%)
Can You Guess the Color?, page B75
What is Your Last Initial?, page B76

Preactivity: Place the collection of 1" square pieces of paper in a bag so students cannot see their distribution. As a class activity, ask a student to take a sample. Record tally or numbers on overhead. Repeat until you have at least 4 or 5 samples recorded. Ask each row to compute the percents reflecting the composition of colors in a sample. Then combine the samples and calculate the percents reflecting the composition of colors in the larger sample. The results of the combined sample should be closest to the composition of the entire collection. Point out the statement at the bottom of page 11.

«CLARIFY CONDITIONS AND LIMITS OF PROBLEM»

Lesson 3 focuses on how to select a random sample and determining "sufficient" size to allow valid predictions to be made.

Problem-solving emphases:
Discussion questions regarding sampling:

≪LOOKING BACK≫

1. Was your sample representative? How closely did it reflect the total population?

≪VERIFY THAT CONDITIONS OF PROBLEM ARE SATISFIED≫

2. How do your experimental results compare with those of your neighbor?

If you combine several students' results on tables 3 and 4 on page 12 (as was done in table 2, page 11), is the result closer to the percents given on circles 1 and 2?

≪VALIDATE RESULTS≫

≪UNDERSTANDING THE PROBLEM: INTERPRETING THE QUESTION≫

3. What projects can you make on the basis of your sample (with colored squares of paper, cards, circles)? Note comments in italics on page 13. The instructions for problems 10-15 really are: Which of the given circles reflects the results of the experiments?

4. If you have access to magazine and newspaper articles analyzing the errors in predictions made by professional pollsters, you may want to assign these as readings (e.g., Newsweek, November 27, 1978, pages 32-33 and Honolulu Advertiser articles on the Fasi-Ariyoshi polls in October 1978).

FOR BETTER STUDENTS

Extension to What is Your Last Initial?

≪APPLY PROCESS TO SIMILAR PROBLEM≫

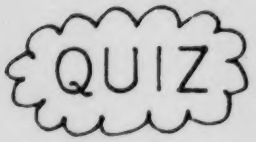
Tally by number of pages (or columns) in a telephone book. Compare your class with the population on your island.

≪LOOKING BACK: WAS MODEL APPROPRIATE?≫

Have students respond to the following questions:

1. Was your class a representative sample? How closely does it reflect the population in the telephone book?

2. How do you account for similarities and/or differences?




Page 16 is a review of Lessons 1-3. Answers are provided for the student on the inside back cover. After this review Quiz 2 may be administered.

Reminder: Ask students to bring in a TV log from the Sunday paper for Lesson 4. Be sure to specify which week so everyone will have the same data.

Other activities:

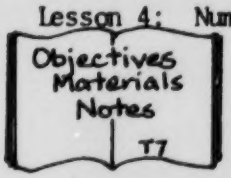
1. Small package of M&M's that are available at Halloween provide an alternative to square pieces of paper. You may use the same worksheet, "Can You Guess the Color?"

   Data may be saved for use in constructing graphs in Lesson 6.

2. Students may be asked to determine the most commonly used vowel in a newspaper or magazine article they bring in. Specify a limit such as 100 words, or a 3 inch square piece of the article for a sample. Have students make a frequency table to organize information. This data may be saved for use in constructing graphs in Lesson 6.

3. Provide students with a coded message that can be deciphered by using a frequency table and the information on page T11 of the teacher's edition.

Pages 17 to 23 Lesson 4: Numerical Facts in Your Newspaper




Read page T7 of teacher's edition of Sampling and Statistics.

Additional objectives:

To find and interpret statistics in a newspaper.
To review ratio and percent equivalents.

Additional materials:

Copies of newspapers (same paper) for each group of two
Copies of a TV log from the Sunday paper

Problem-solving emphases:

≪USE OF RESOURCES≫

≪RELATE TO "REAL-WORLD"≫

Students may be asked to locate statistical information in the paper. Daily features include the weather, sports, and stock market reports. Other uses of statistics may be found in advertisements and news articles on the economy.

≪CLARIFY CONDITIONS OF THE PROBLEM≫

The TV log and duplicating master D16 provide students with an opportunity to collect and tabulate their own data. Recall that 1 tally = 1/2 hour. (A three-hour movie = ___ tallies?)

Save this data for constructing graphs in lessons 6 and 7.

This activity can be used to emphasize statistical and problem-solving concerns:

≪DETERMINE WHAT INFORMATION IS NEEDED≫

What criteria should we establish for each category? (You may pick a particular program and have students determine where to categorize it.)

≪ANALYZE VALIDITY OF DATA≫

How representative is the programming for the selected week? (Is there a mini-documentary or special sports event?)

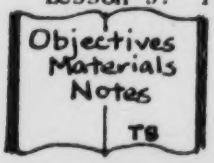
How can we self-check the data? (Since the number of half-hour time intervals is set, the total number of tallies must be a constant. Otherwise, an error was made.)

Other activities:

≪USE OF RESOURCES TO OBTAIN INFORMATION≫

Many governmental agencies and departments have pamphlets and booklets containing statistical information in almost every area. Your students may want to pursue a project related to how such data are collected and presented, or the implications of the data.

Pages 24 to 27 Lesson 5: Pictures of Facts




Read page T8 of teacher's edition of Sampling and Statistics.

Additional objectives:

To recognize that how data are displayed can affect the interpretation of that data.

To determine appropriate scales for both axes.

Additional materials:

Finding Patterns I, pages B77-B78
Finding Patterns II (optional), page B79
Visuals A, B, C, pages B80, B81, B82

Problem-solving emphases:

Finding Patterns I, pages B77-B78

Discussion questions include:

≪ANALYZE RELATIONSHIPS≫

Are the numbers increasing? decreasing? In which problems do the numbers have equal differences?

≪LOOK FOR PATTERNS≫

For problems 1-6, what are the next three numbers? For problems 7-9, can you make up three more examples that fit the pattern?

Visuals A, B, and C help to provide students with the background for reading graphs. Students should realize that graphs can be deceptive or meaningful. Hence, it is important for students to learn to read a graph properly.

In the discussion of these visuals, ask students to point out what they see (for example, the title, vertical and horizontal scales, etc.) that help in reading the graphs. Ask students for comparisons, trends, or generalizations.

For a class project, have students bring in examples of graphs that are misleading or deceptive. Sources for these graphs include newspapers, magazines, and reports by banks, utilities, and other companies. These graphs may be made into a bulletin board display illustrating the types of deceptive practices, or into a worksheet containing a few of these examples for class discussion.

Visuals A, B, and C illustrate the following misleading practices:

Visual A: Enlargement

≪IS DATA: ACCURATELY DISPLAYED? EASILY READ?≫

While the dimensions of the larger package of seeds are double that of the smaller, the area of the larger package is four times that of the smaller.

Using a standard unit makes it easy to compare amounts.

Visual B: False Bottom

≪DOES GRAPH LEAD TO: MISINTERPRETATION? WRONG CONCLUSION?≫

Graph does not begin at zero. The first vertical unit represents $1100 while each remaining unit represents $100. The first impression is that spending has doubled. However, a closer look indicates otherwise.

This problem can be avoided by using equal units on the vertical axis, or by showing a break in the axis to indicate that a part has been removed.

Visual C: Stretching the Point

Since the graph at the top does not begin at zero, the company's income appears to have risen sharply in 1978. The more objective graph at the bottom reflects the company's rise.

This problem relates to line graphs.

The following is a suggested list of questions for critiquing graphs. Other points that your students make should be added.

≪IDENTIFY KEY ELEMENTS≫

1. Does it have a title and labels?
2. If it is a pictograph
   a. is it an enlargement?
   b. is there a standard unit?
   c. is a key provided?

≪ANALYZE PATTERNS≫

3. If scales are used
   a. does it start with zero?
   b. is there a break shown?

c. are the scales evenly spaced?

d. do the scales reflect a numerical pattern? (E.g., 2, 4, 6,... or 10000, 20000,...)

«IS THE INTERPRETATION JUSTIFIED?»

4. How would the illusion of the graph be changed if the horizontal or vertical scales were stretched or reduced?

Other activities:

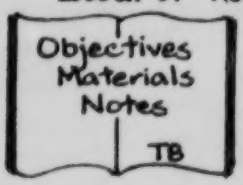
In addition to the results of questions 7 and 11, other data that your class has collected may be graphed. Examples include the results of experiments (colored squares, M&M's, or vowels) from Lesson 3.

«APPLICATION TO "REAL-LIFE" SITUATION»

Throughout Lessons 5-7, ask students to bring in graphs from newspapers or magazines. Class discussion could focus on:

--critique of graphs (e.g., labeling, scales, use and misuse)
--interpretation of graphs (e.g., trends, implications, predictions)
--reason for selecting the particular type of graph (e.g., bar, line, circle)

Pages 28 to 31 Lesson 6: More Pictures of Data




Read page T8 of teacher's edition of Sampling and Statistics.

Problem-solving emphases:

Some of the data in Lesson 5 may be used to construct circle or rectangular graphs. Using their own graphs the class can now discuss the appropriate uses for each type of graph:

«DETERMINE HOW TO PRESENT DATA»

1) Line graphs are used to show trends; that is, the line graph usually shows changes relative to time.

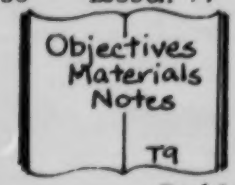
2) Circle graphs are used to compare the parts to the whole. (The parts are usually given as percents.)

3) Bar graphs are usually used to compare distinct pieces of information.

≪DIFFERENTIATE BETWEEN REASONABLE & ABSURD≫

The puzzles on the bottom of page 31 could initiate a discussion on misleading statistics and the need to study them critically to get the correct information and interpretation.

Pages 33 to 38 Lesson 7: Graphs of Your Town




Read page T9 of teacher's edition of Sampling and Statistics.

Problem-solving emphases:

CRITICAL THINKING:

≪APPLY PROCESS TO SIMILAR SITUATIONS≫

≪GENERALIZE PROCESS≫

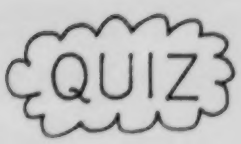
≪ORGANIZE DATA INTO TABLES AND GRAPHS≫

≪DETERMINE NATURE OF ANSWER≫

This lesson provides students with an opportunity for a comprehensive review. The class will need to review the considerations required for random sampling, sample size, collecting the data, organizing the information, presenting the data in an appropriate form, and analyzing and interpreting the results.

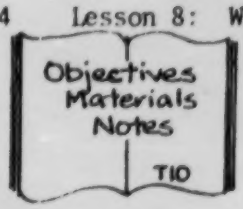
A project, undertaken individually or in small groups, for a topic related to the school or the community provides for additional application of the concepts covered. Examples of topics include questions related to favorite fast foods, favorite subject in school, amount of time spent on commercials during specified times. This project requires students to determine:

What method of sampling would provide a representative sample? What kind of data do we need to make a decision or come to a conclusion? How should the data be presented? What conclusions can be inferred from the data? Is this conclusion valid? Why?




After the review, administer Quiz 3.

Pages 40 to 44 Lesson 8: Who is the Man in the Middle?




Read page T10 of teacher's edition of Sampling and Statistics.

Additional materials:

What is the Median?, page B83
Median, page B84

Problem-solving emphases:

≪CLARIFY MEANING OF TERMS≫

≪APPLY DEFINITION≫

≪ANALYZE CRITERIA≫

Highlight the need for careful reading of mathematical definitions. Write the definition of median on the board. Use a transparency of "What is the Median?" and have students determine the median for each set of data. Note that the data in problems 3 and 5 are the same, as are the data in problems 1 and 7, and problems 4 and 6. Pose leading questions to help students refine their definition of median. For example, to begin the discussion with problem 1, if students say that the median is 2, ask them what the median for 2, 3, 6, 5, 3 is. If the data are the same, shouldn't the median be the same also?

≪DETERMINE WHAT IS GIVEN≫

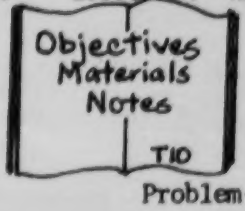
Students find tables difficult to understand. Compare problems 3 and 5, 1 and 7, 4 and 6 to help them find shortcuts to determining the median when data are displayed on a table.

≪APPLY PROCESS TO SIMILAR PROBLEMS≫

Bring in frequency tables made by students in previous lessons and find the medians.

Reminder: Have students bring in newspaper or magazine articles for Lesson 9.

Pages 46 to 50 Lesson 9: Who is the Typical Man?




Read page T10 of teacher's edition of Sampling and Statistics.

Problem-solving emphases:

≪DEVELOP READING SKILLS≫

Have students read the definition of mode at the top of page 46. D19 may be used as a basis for class discussion to help students clarify their definition of mode.

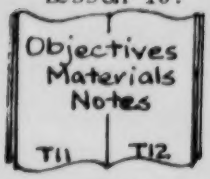
≪CLARIFY MEANING OF TERMS≫

A common error is to select the number representing the highest frequency as the mode. For example, in problem 8 on D19, the mode is 10 (minutes) and not 5 (students).

≪APPLICATIONS TO SIMILAR PROBLEMS≫

Other sources of examples include students' previous work in constructing tables (page 44) and graphs (page 38).

Pages 51 to 57 Lesson 10: Who is the Average Man?




Read pages T11 - T12 of teacher's edition of Sampling and Statistics.

Additional materials:

Median, Mode, Mean, page B85
The Average, page B86

Problem-solving emphases:

«CLARIFY MEANING OF TERMS»

The Average highlights seven key words in this statistics unit. It could be used to test students' knowledge of this vocabulary.

«APPLY A SIMILAR TECHNIQUE»

Median, Mode, Mean consists of the identical data and format as a previous worksheet, Median, in Lesson 8. The new items are problems 7 and 8. Students can apply their knowledge of reading tables to these two problems on finding the mode and mean.

«STUDY IMPLICATIONS»

Part D, on page 55, is extremely important. The suggestions to the teacher provide examples to help students differentiate among the three measures. Elicit from students their own methods of differentiating between the three measures and when each may be used.

Another way to help differentiate between the three measures of central tendency is to have students look for articles in magazines and newspapers that refer to "average," "typical," or "median." For example, the two articles below report on U.S. income and appear, at first, to be in conflict. On more careful reading, students can see that one article provides income per family while the other reports on income per person. Moreover, different measures are used; one uses the median while the other appears to use the mean.

From PARADE MAGAZINE, November 25, 1979.

**Swiss Richest** The 1978 figures are just in, and the Swiss have overtaken the Kuwaitis as the world's wealthiest people, according to the Union Bank of Switzerland.

National income in Switzerland last year averaged $13,883 per person, compared to Kuwait with $13,000 per inhabitant. Denmark ranked third with $10,948; Sweden fourth with $10,440; West Germany fifth with $10,415.

Rounding out the top 10, Belgium was sixth with $9939; Norway seventh with $9849; the U.S. eighth with $9646; the Netherlands ninth with $9567; and Saudi Arabia tenth with $9550.

# Median income at $17,640 during 1978

By SPENCER RICH
*Washington Post Service*

WASHINGTON — The median income of all U.S. families reached $17,640 last year, a rise of 2.4 percent over 1977 after adjustment for inflation, the Census Bureau reported yesterday.

The median income is a dividing point defined such that half of all families earned more than the median, half earned less.

In 1977, the actual dollar median income of U.S. families was $16,009 — so in nominal dollar terms median income rose about $1,600 in 1978. But after adjusting for loss of purchasing power as a result of inflation, the real increase during 1978 in terms of constant 1975 dollars was only about $414 — or 2.4 percent.

The bureau also calculated that in terms of real spending power, median family income rose 6.3 percent from 1970 through 1978, after adjustment for inflation. This is an average of 0.8 percent a year — a far slower pace than from 1960 to 1970, when the average rise was 3 percent a year. The recession of late 1973 to 1975, when real median income of families actually fell, pulled down the average for the 1970s.

The new income figures indicate that, although the economy is still expanding, income improvements aren't moving nearly as fast as they were in the 1960s. At that time, there was widespread expectation that living standards would simply keep rising at a substantial rate each year.

Since then, however, the vastly higher cost of imported oil, plus a slowdown in the growth of productivity for reasons which still aren't fully understood, has placed a brake on the growth of income. Some economists believe it is no longer possible to take care of all the unmet needs of the poor and sick while still improving living standards for the rest of society.

Poverty figures reflect this: the decline in the proportion of poor has virtually stopped.

In its annual survey of income and poverty, the bureau also reported that the 1978 total of persons below the poverty line ($6,662 for a non-farm family of four) declined only slightly — by 200,000 — from 1977. It was 24.5 million in 1978 — 11.4 percent of the population.

The overall figures mask major differences among social groups and among regions.

For example, while overall median income was $17,640, it was higher for Caucasians — $18,370 — and substantially lower for Hispanic families ($12,570) and black families ($10,880).

The North Central states had the highest regional median, $18,600, the West had $18,410 and the Northeast $18,190. The South pulled the average down with $15,940.

Similarly, while the national poverty rate was 11.4 percent overall, for Caucasians it was 8.7 percent, for blacks 30.6 percent and for Hispanics 21.6 percent.

The South had the most poor — about 42 percent of the national total, although it has only a third of the national population.

While the median income of families was $17,640 in 1978, separate calculations show that the figure for unrelated individuals was only $6,705.

Although real median family income has risen over the past few years after falling off sharply during the 1973-75 recession, the 1978 figure didn't reach the high achieved in 1973. In that year, just before the recession, the median was $17,683 (expressed in 1978 dollars).

The Census Bureau figures show that if you made $25,000 or more in family income in 1978, you made more than about three-quarters of all U.S. families. Although 16 million families made $25,000 or more, more than 41 million made less — and a quarter of all families were below $10,000.

The family figures also indicate that the more education you have, the less likely you are to be poor. Among families headed by a person with at least one year of college, only 3.4 percent were below the poverty line. The figure was over 20 percent for families headed by someone who hadn't completed elementary school.

Among certain groups, poverty levels were extraordinarily high. Black families headed by women without a husband present had poverty rates ranging from 42 percent where there was only one child to 83 percent where there were five or more children. The rates were lower, but still rather high, for similar white female-headed families.

By occupation, the highest family poverty rates occurred among service and household workers (15.5 percent) and farm workers (17.4 percent). Professional and managerial workers had a family poverty rate of only 2.2 percent.

From The Sunday Star-Bulletin and Advertiser, November 25, 1979.

For better students questions that may be investigated include:

«INVESTIGATE RELATIONSHIPS» --Under what conditions is the mean greater than the median?

«ANALYZE FACTS» --Would you rather have the mean income in Hawaii or the median?

--How can using one of these measures provide misleading information?

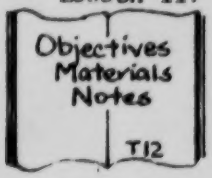
Other activities:

Estimations of measures of objects around the classroom may be collected. The mean, median, and mode of each set of data may be found.

Test scores could be used as data. Students could find the mean of their test scores for the quarter. Also, the class results for a particular test could be used as data and students can look for the mean, median, and mode for the test.

Have students bring in articles and advertisements from newspapers and magazines with reference to typical, average, median, mean, mode for the bulletin board or class discussion.

Pages 58 to 60 Lesson 11: How Do You Rate:

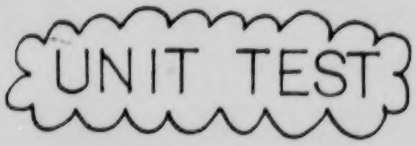



Read page T12 of teacher's edition of Sampling and Statistics.

Problem-solving emphases:

«READING SKILLS IN MATHEMATICS» Use pages 58 and 59 to test how well students learned to read directions and follow through. Ask students to do these pages on their own to see if they can figure out what the words rank, range, and percentile rank mean. Tell them not to spend the whole time on one section but to go through all three sections in, say, twenty minutes. Use the problems on D22 as a basis for class discussion to clarify the definitions and see if students are able to apply the definitions to specific examples.

«APPLY TO "REAL-WORLD"» While standardized tests provide a relevant example, rank and range can be found for a number of sports statistics. Other sources include data from health, science, and population studies.




A unit test for Statistics and Sampling is provided on pages B97-B99.

ANSWER KEY

## Pages B65-B66 Identifying Facts

1. d  2. b  3. b  4. c  5. d

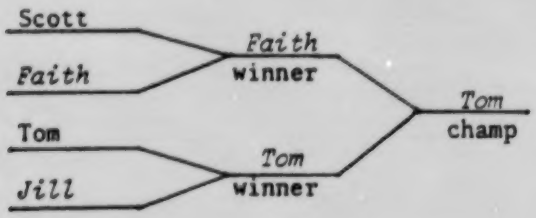
6. b  7. b  8. c  9. a

## Pages B67-B68 Relating Facts

1. a  2. d  3. a  4. d  5. I. c  II. c  6. I. c  II. b

## Pages B69-B70 Relating Facts Logically

1.




2.

| | R | S | A |
|---|---|---|---|
| 10th | X | • | X |
| 11th | X | X | • |
| 12th | • | X | X |

10th = Shirley
11th = Ann
12th = Ron

3.

| | D | J | M |
|---|---|---|---|
| F | X | • | X |
| B | X | X | • |
| V | • | X | X |

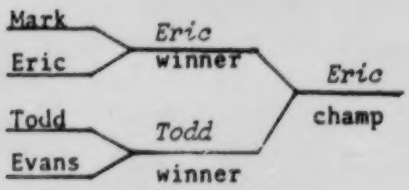
Dave = volleyball

4.

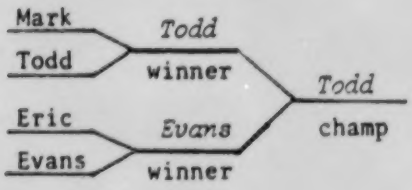
| | A | B | C | D | E |
|---|---|---|---|---|---|
| I | X | X | X | X | • |
| M | • | X | X | X | X |
| P | X | X | • | X | X |
| K | X | • | X | X | X |
| J-R | X | X | X | • | X |

Ann - Max
Bob - Kurly
Carol - Pepper
Dave - J-R
Ed - Inky

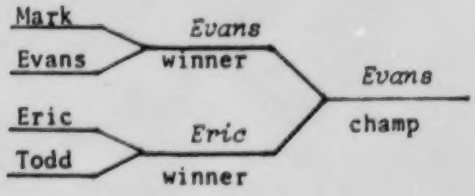
5. Tournament 1




Tournament 2




Tournament 3



## Pages B77-B78 Finding Patterns I

1. 25, 29, 33, 37

2. 48, 96; Multiply by 2

3. 16, 22, 29, 37; Add 1, 2, 3,...

4. 109, 103, 96; Subtract 1, 2, 3,...

5. 3-1/4, 3-1/2, 3-3/4; Add 1/4

6. 5/27, 5/81, 5/243; Divide by 3 or multiply by 1/3

7.

| x | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|
| y | 5 | 4 | 3 | 2 | 1 | 0 |

$x + y = 12$

8.

| p | 19 | 3 | 0 | 9 | 2.1 |
|---|---|---|---|---|---|
| r | 24 | 8 | 5 | 14 | 7.1 |

$p + 5 = r$

9.

| e | 3.7 | 3.1 | 6.81 | 13.3 | 6 | 3.01 |
|---|---|---|---|---|---|---|
| f | 2.6 | 2 | 5.71 | 12.2 | 4.9 | 1.91 |

$e - 1.1 = f$

10. a.

| Stop No. | People Boarding | Total |
|---|---|---|
| 1 | 1 | 1 |
| 2 | 3 | 4 |
| 3 | 5 | 9 |
| 4 | 7 | 16 |
| 5 | 9 | 25 |
| 6 | 11 | 36 |
| ⋮ | ⋮ | ⋮ |
| 9 | 17 | 81 |
| ⋮ | ⋮ | ⋮ |
| 25 | 49 | 625 |

b. consecutive odd numbers

c. squares of integers

d. 3rd column = (1st column)$^2$

*f. 2nd column = (2 x 1st column) - 1

## Page B79 Finding Patterns II

1.

| x | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| y | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |

2.

| H | 6 | 7 | 9 | 11 | 16 |
|---|---|---|---|---|---|
| M | 36 | 42 | 54 | 66 | 96 |

$H \times 6 = M$

3.

| a | 1 | 2/3 | 3 | 11 | 1½ | 9 |
|---|---|---|---|---|---|---|
| b | ½ | 1/3 | 1½ | 5½ | 3/4 | 4½ |

$a \times \frac{1}{2} = b$ or $a \div 2 = b$

4.

| a | 8.7 | 3.3 | 8.93 | 3.71 | 4.9 | 14.72 | 9.08 |
|---|---|---|---|---|---|---|---|
| b | 6 | .6 | 6.23 | 1.01 | 2.2 | 12.02 | 6.38 |

$a - 2.7 = b$

Page B79 Finding Patterns II (continued)

5.

| Vehicle | # People in Vehicle | Total # at Picnic |
|---|---|---|
| 1 | 1 | 1 |
| 2 | 3 | 4 |
| 3 | 5 | 9 |
| 4 | 7 | 16 |
| 5 | 9 | 25 |
| 6 | 11 | 36 |
| 7 | 13 | 49 |
| ⋮ | ⋮ | ⋮ |
| 10 | 19 | 100 |
| ⋮ | ⋮ | ⋮ |
| 25 | 49 | 625 |
| n | 2n - 1 | $n^2$ |

Page B84 Median

1. 3 children
2. Quiz score - 8
3. Height - 160 cm
4. $125 salary
5. a. Team A: 8 pts.
   Team B: 6½ pts.
   b. Team A
6. 16 years old

Page B85 Median, Mode, Mean

1. 3 children
2. Quiz score - 8
3. Height - 160 cm
4. $125 salary
5. a. Team A: 8 pts.
   Team B: 6½ pts.
   b. Team A
6. 16 years old

7. Mode:
   1. less than 3 children
   2. score - 8
   3. height - 160 cm
   4. $125 salary
   5. Team A: 8 and 6 pts.
      Team B: 6 pts.
   6. 17 years old

8. Mean:
   1. not possible
   2. score - 7
   3. height - 159 cm
   4. $152 salary
   5. Team A: 8 pts.
      Team B: 7 pts.
   6. not possible

Page B86 The Average

1. table
2. survey
3. mean
4. frequency
5. median
6. graph
7. mode

Page B91 Quiz 1

1. 45; 45 2. Barbara; 90; 92 3. 25% 4. 60 5. 6%

Page B92 Quiz 2

1. 12% 2. 4/100 3. 25 times 4. 40% 5. 75 chocolates

6.

| Favorite Color | Tally | Number | Ratio | Percent |
|---|---|---|---|---|
| Red | 𝍸 | 5 | 5/25 | 20% |
| Green | 𝍸 \|\| | 7 | 7/25 | 28% |
| Orange | 𝍸 \|\|\|\| | 9 | 9/25 | 36% |
| Blue | \|\|\|\| | 4 | 4/25 | 16% |
| Total | | 25 | | 100% |

Pages B93-B95 Quiz 3

1. 65 2. 2 3. 33 1/3% or 33% 4. 60%

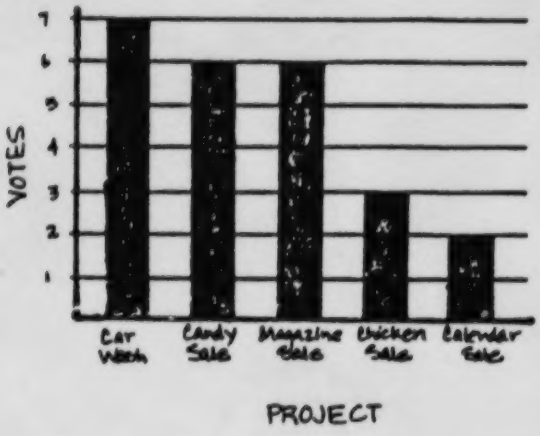
5. false bottom 6. stretching the point

7. savings and loans 8. $12,000,000 x .18 = $2,160,000 or $2.16 million

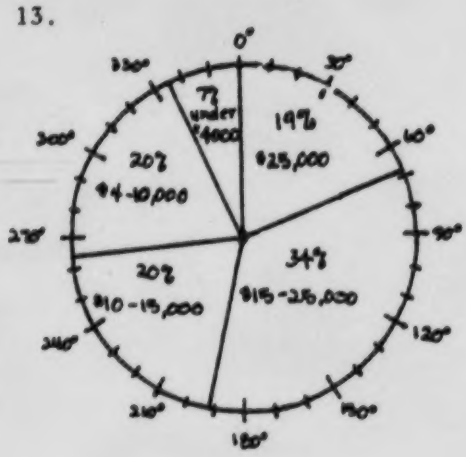
9. 70 students 10. 40 + 60 + 30 + 70 = 200 students

11. 40/200 = 20%

12.




13.



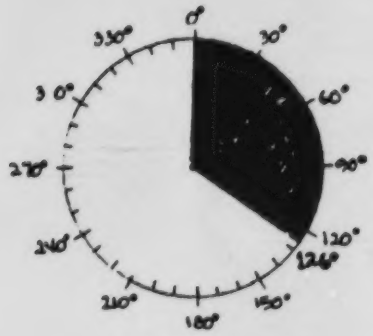
Page B96 Quiz 4

| | | | | |
|---|---|---|---|---|
| 1. 35 | 2. 30 | 3. 43 | 4. 40 | 5. 42 |
| 6. 39 | 7. 38 | 8. 21 | 9. 4 | 10. 40 |

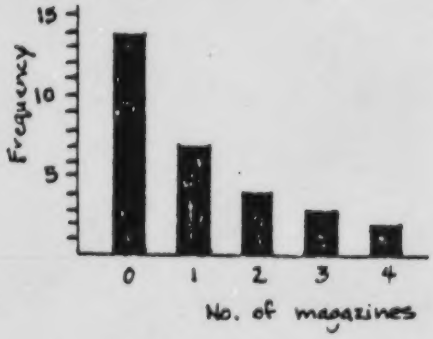
Pages B97-B99 Unit Test

| | | | |
|---|---|---|---|
| 1. 45 | 2. 66 2/3% or 67% | 3. 80 | 4. 8% |
| 5. 2/100 | 6. 200 blue marbles | 7. 4 hearts | |

8.




9.




| | | | |
|---|---|---|---|
| 10. 30% | 12. 11 | 14. 10% | |
| 11. 42 | 13. 5/30 | 15. 8¢ | |

| | Median | Mode(s) | Mean |
|---|---|---|---|
| 16. | 5 | 5 | 5 |
| 17. | 23 | 18 | 25 |
| 18. | .05 | .06,.04 | .05 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 19. 78 | 20. 78 | 21. 80 | 22. 24 | 23. 3rd | 24. 52% |
|---|---|---|---|---|---|

UNIT II - METRIC

## DESCRIPTION OF METRIC UNIT

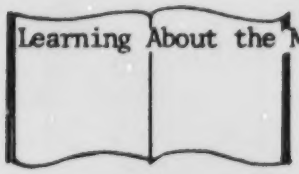
This unit is based on the booklet, Learning About the Metric System in High School, that was developed by the Curriculum Research and Development Group of the University of Hawaii for the Department of Education. The teacher's edition of this booklet includes a description of its content and approach. In addition, quizzes and tests are provided in the teacher's edition.

The problem-solving component of this course is incorporated into the "Suggestions for Teaching Learning About the Metric System in High School" beginning on page B38. This section replaces the one provided in the teacher's edition on pages iv to xiii.

The Suggestions for Teaching section provides an outline of objectives, problem-solving behaviors, materials needed, comments, and teaching suggestions. Specific problem-solving skills that relate to the metric activities are flagged out between double arrows, ≪....≫ , in the left-hand margin.

The diagram below displays the major elements of this unit:

Metric Unit


Learning About the Metric System in High School, Hawaii
State Department of Education
a. student text ($2.00)
b. teacher's edition (including quizzes and tests) ($4.00)
Teacher's Commentary
pages B37 - B60
Masters for Worksheets and Transparencies
pages B87 - B90

## RELATED PROBLEM-SOLVING BEHAVIORS

The following may be used as a teacher reference or as a basis for a class discussion. Resulting ideas can be added to the list of problem-solving behaviors that can be applied to the study of metric measurement.

1. Understanding the Problem

   --understand the vocabulary for metric units
   --build reference units for the common metric units
   --develop mental pictures of the relative size and relationship of the metric units
   --determine the accuracy of the answer required (to the nearest ____)

2. Devising a Plan

   --determine what instruments would be appropriate
   --guess and check by experiment
   --look for patterns (especially in conversion problems)

3. Carrying Out the Plan

   --demonstrate or explain your approach
   --generalize your results

4. Looking Back

   --Can you explain what steps you used to solve the problem?
   --Can you use these steps to solve similar problems?
   --How can you resolve discrepancies in different students' answers?
   --Is your answer reasonable? How do you verify it?

## SUGGESTIONS FOR TEACHING LEARNING ABOUT THE METRIC SYSTEM IN HIGH SCHOOL

To aid the teacher in teaching Learning About the Metric System in High School, an outline of objectives, problem-solving behaviors, materials needed, comments, and suggestions for other activities are provided below for each lesson. Many of the problem-solving behaviors identified are expanded upon in the comments sections. These behaviors should be encouraged and developed as the unit progresses. Exercises referred to in the commentary are located in the student text unless otherwise noted.

The teacher is encouraged to keep a log of the daily lessons on the space provided next to the outline. Questions, such as "How can I teach this better the next time?", "Were materials sufficient?", "Is the activity more successful working in pairs or individually?", "Can I extend the lesson for the faster students?", etc., can be answered in the daily log.

Reminder:

| Page Label | Where Found |
|---|---|
| i - xxii | Teacher's Edition of text |
| 1 - 58 | Student Text |
| B37 - B60 | Teacher Commentary |
| B87 - B90 | Masters for Worksheets and Transparencies |

Introduction

Objectives: Understand the importance of reading directions.
Understand the use of and need for the metric system.

Problem-solving behavior:
Read and follow directions.

Materials: "Pre-Test", page B40

Comments: Tell the students they are about to begin a new unit, but before work on it begins, you need to test certain computational skills. Tell them the results will not count toward their final grade so there is no need to be anxious. Administer the test. Once the test has been "completed" ask the students how they felt once they realized they did not need to solve every problem. Ask them what lesson should be learned from this experience (Read and follow directions!).

«FOLLOW DIRECTIONS»

Begin discussing the metric system by asking students how many have heard of it. Who uses the metric system? Can they give examples of the metric system in use in this country (state)? Examples might include buying gasoline by the liter and running in a ten kilometer race. What are some of the pros and cons of the metric system? Why should the metric system be studied? Have the class read pages 1 and 3 of the student book.

Other activities:

1) Have the students ask their friends what they know about the metric system: do they ever see or use the metric units, etc.

2) Have the students determine if any of the metric units are used by grocery stores, by department stores, by government offices, and so on.

Applications $B_1$ - Metric

Pretest

Name _____

Date _____

Directions: Read all of the problems carefully before you begin. Then solve the problems as instructed.

1. $34.8\overline{)1234567}$ 1. _____

2. $784.1 \times .36 =$ _____ 2. _____

3. 5% of \$5555 = _____ 3. _____

4. How many seconds are there in one day? 4. _____

5. $\frac{780}{306} + \frac{507}{846} =$ _____ 5. _____

6. How many different ways can you make change for a quarter? 6. _____

7. Find the pattern and fill in the missing numbers: 7. _____

   1, 1, 2, 3, 5, 8, 13, ___, ___, ___

8. $\frac{12}{30} =$ _____% 8. _____

9. Add 7 to 100. 9. _____

10. Now that you have read all the problems, do only number 9. Turn your paper over and sit quietly. 10. _____

## Pages 5 to 7 Metric Rulers

Objective: Know the names of common metric rulers.

Problem-solving behaviors:
Make a physical model.
Introduce suitable notation.
Brainstorm.
Look for a similar problem solved before.
Look for patterns in the data.
Make and verify conjectures.
Check your result and process.
Generalize your solution process.
Apply the process used to solve similar problems.

Materials:
Transparency 1, page B87
Meter sticks (about 6)
Adding machine tape (1 roll) cut off into longer than 1 meter lengths--one for each student
Scissors (enough to be shared in the classroom)
Oak tag or other hard paper (28 cm x 5 cm) --one for each student
Glue (about 6 bottles)

Comments: Introduce this section by using the transparency provided. The centimeter ruler should be cut from the transparency and placed over the millimeter ruler to demonstrate the relationships. Ask the students to generalize about their answers. Do they notice any patterns? They might note things such as

«GENERALIZE»

«PATTERNS»

--the number of millimeters is always larger than the number of centimeters.
--you can't just "add a zero"; it doesn't always work.
--the decimal moves one place to the left (right) when changing from centimeters to millimeters (or vice-versa).

«MAKE AND VERIFY CONJECTURES»

Once they make the generalizations have the students make up new problems so these "hypotheses" can be tested and verified.

ORGANIZE!

While some students are using the classroom meter sticks to cut off their meter strips, other students can be working on cutting and pasting their centimeter and millimeter rulers on page 5. This can be completed with a minimum of confusion, but organization and management are very important.

## Pages 8 to 9 The Meter

Objectives: Measure to the nearest meter.
Build frame of reference for the meter.

Problem-solving behaviors:
Clarify meaning of terms.
Brainstorm on given information.
Estimate.
Compare.
Contrast strategies.
Make and verify conjectures.
Differentiate between logical and illogical.
Use a physical model.
Define problem.

Materials: Transparency 2, "Guesstimating," page B88
Worksheet 1, "Pizza Party," page B89
Classroom demonstration meter sticks
Students should have their own 1-meter tape.

Comments: Use the transparency (page B88) to introduce estimation activities. Emphasize that estimates are not expected to be accurate. Students often feel they will be marked wrong for an estimate that is not exact.

≪CLARIFY MEANING OF TERMS≫

The meaning of the phrase "nearest unit" should be developed in this discussion. "Estimate the height of the door to the nearest meter. Estimate the number of people in this school to the nearest hundred." Point out that not all estimates can be verified, e.g., the number of whales in the world. Ask the students why estimations are useful. (E.g., They are useful when accuracy is not necessary, useful in checking reasonableness of answers to computation problems.)

≪ESTIMATE≫

Ask the students when they can use estimates.

≪COMPARE≫

Emphasize that comparisons are frequently used as an estimation tool (e.g., since the door is approximately 2 m high, the room must be approximately 3 m high). The "Pizza Party" worksheet provides an opportunity for the students to practice one type of estimation.

Emphasize that the meter is the main metric unit of length. All other units are derived from it.

In exercise 3, students should realize that their answers will vary. Different students will have a different pace and therefore, a different "body measure" for meter.

Before assigning exercises 2 and 4 be sure you know the measurement of each object. Students will want to know if their work is accurate.

≪COMPARE≫

In exercise 5 the students should compare objects with known measurements to those given. They should also distinguish between logical and illogical answers.

≪LOGICAL vs. ILLOGICAL≫

≪DEFINE THE PROBLEM≫

In the Brainbuster problem (exercise 7) students must first define the problem. What is meant by "opposite corner?" Are there any restrictions on where the spider's web can be spun? What is meant by shortest web? Next they must brainstorm the solution. What approach should be taken? Is it better to spin the web where walls join or along the diagonal of a wall? And so on.

≪BRAINSTORM≫

Other activities:

1) Point to a section of the chalkboard and have students guess the length to the nearest meter.
   Record the guesses on the board.
   Select a student to measure the chalkboard section and write the measurement on the board.
   Determine the best guesser or the best row of guessers.

2) Have students interview three people during the day and ask, "How long is a meter?" Record their findings on the board to determine what percent of people interviewed generally know how long a meter is.

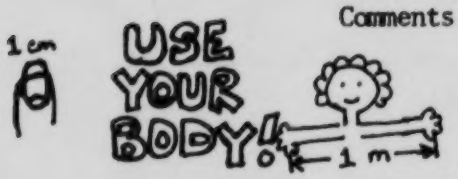
3) Have students measure athletic areas around the school such as a volleyball court, tennis court, basketball court, etc. to the nearest meter.

## Pages 10 to 12 The Centimeter

Objective: Measure to the nearest centimeter.

Problem-solving behaviors:
Look for a similar problem solved before.
Estimate.
Verify conjectures.
Experiment.
Determine whether data is sufficient.

Materials: Centimeter ruler
String (about 60 cm long -- enough to be shared in the class)
Centimeter height measure taped on a wall




Comments: In exercise 4, students will need string to measure wrist and head. Encourage students to use lengths of familiar objects, such as body parts, to sharpen estimation skills.

To solve the Brainbuster (exercise 6), students should realize they need more information. Before they can solve the problem, they must measure the width of the classroom.

≪SUFFICIENT DATA?≫

## Pages 13 to 14 Perimeter

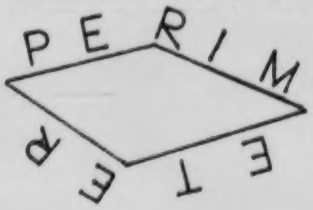
Objective: Find the perimeters of polygons.

Problem-solving behaviors:
Use resources to clarify meaning of terms.
Apply information given.
Work the problem backwards.

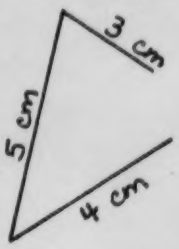
Materials: Centimeter rulers

Comments: There is a tendency for students to confuse perimeter and area. The diagram below can be used to "summarize" the idea of perimeter.

≪CLARIFY MEANING OF TERMS≫




For exercise 3, students are most likely to begin by drawing a figure that is not a polygon. Encourage them to use trial and error to draw a closed figure (polygon). The figure shown has a total length of 12 cm, but we do not say, "It's perimeter is 12 cm" because perimeter means distances around.




≪APPLY GIVEN INFORMATION≫

In exercise 4 students are given a scale measurement and asked to apply it to given diagrams. Be sure students are familiar with and understand the concept of scale drawings.

≪WORK BACKWARDS≫

Have the class solve exercise 5 (the brain-buster) together. Ask the students to describe the technique they are using--working backwards. Explain that this technique is often used in real-life situations. People know what final results are wanted and they work backwards to determine how to get them. This technique can be used advantageously in multiple choice exams when a method for solving the problem is not known.

Other activities:

1) Have students work in pairs. One student draws five line segments and the partner estimates and measures their lengths. Partners then alternate their activities. Do this until each student can correctly estimate four out of five times.

2) Have students in each row guess the length of an object. Select a different item for each row. Each row will discuss the length of their object and agree on the length. The length of their object will then be measured and the best row of guessers is chosen.

## Pages 15 to 17 The Millimeter

Objectives: Measure to the nearest millimeter.
Add and subtract measurements.

Problem-solving behaviors:
Compare.
Make and verify conjectures.
Clarify meaning of terms.
Apply another technique to solve the same problem.
Check your result.

Materials: Millimeter ruler
Five nails of different lengths, labeled A, B, C, D, E
Coins--penny, nickel, dime, quarter

Comments: The need for a unit smaller than the centimeter can be suggested when measuring such objects as the thickness of eight sheets of paper or the thickness of a dime.

≪COMPARE≫

Exercise 1 gives the students another chance to compare the units of measurement. Again, formal methods of conversion should not be

emphasized. However, statements of generalities or recognition of patterns should be encouraged.

The nails and coins used in exercises 2 and 3 may create classroom management problems. They should be placed in different parts of the room to avoid congestion or they can be passed around the room. If available, duplicate sets of nails would be helpful.

When measuring in millimeters expect variations in answers.

«CHECK YOUR RESULTS»

«APPLY ANOTHER TECHNIQUE»

During the discussion of exercise 5 emphasize Polya's fourth step to problem solving: Looking Back. Ask the students how to use these problems to double-check their results. They are actually applying a second technqiue to solve the same problem (convert to another unit, solve, and then compare answers).

Other activities:

1) For a five-minute activity, have students estimate the length of various objects. This activity can be done throughout the year.

2) Have students bring to class objects, such as gum wrap, candy wrap, etc. and display on the bulletin board with the measurement of the length and/or width shown.

## Pages 18 to 21 The Kilometer

Objective: Know that 1 km is shorter than a mile
and 8 km is about 5 miles.

Problem-solving behaviors:
Recognize patterns.
Read tables.
Apply information given.
Compare (distances).

Materials: None

Comments:

≪RECOGNIZE PATTERNS≫

In exercise 1, have students analyze the method used to convert miles into kilometers. Ask several students to describe the patterns they see.

≪UNDERSTANDING THE PROBLEM≫

Ask the students why an "X" appears in some of the regions on the table. Why aren't there numbers in these spaces?

≪APPLY INFORMATION≫

Exercise 3 requires the students to apply information they learned in the first exercise.

The frame-of-reference, "8 kilometers is about 5 miles," is given in exercise 4. Students are asked to compare distances between communities and to find communities about 8 kilometers apart.

Encourage students to do the 1 kilometer homework activity. For exercise 2, emphasize that a measurement is shown by a numeral and a unit. This is a good time to review symbols in SI.

Other activities:

1) Have students describe locations north, east, south and west of their homes that are 1 km away. Others in the class will guess the approximate location of that student's home.

2) Have students construct a speedometer scale for the family car in kilometers.

## Pages 22 to 24 Meter, Centimeter, Millimeter, Kilometer

Objectives: Use the units of length and their symbols.
Recall the meanings of the six metric prefixes.
Select the best measurement.
Select the most appropriate unit.

Problem-solving behaviors:
Estimate.
Compare.
Apply the process used to solve similar problems.
Differentiate between reasonable and absurd.
Looking back.

Materials: Meter, centimeter and millimeter rulers

Comments: This lesson reviews the commonly used metric units of length. Students should develop familiarity with the metric prefixes and their meanings.

«ESTIMATE»

Begin this lesson with some estimation practice. Ask the students to name an object in the room which is about 5 m long, about 30 cm long, and so on. Point to or hold up a specific object and ask students to estimate its length. After students have estimated, have someone measure the object. Then ask how they can use the knowledge that the object is "x" cm long to estimate the length of a second object.

«COMPARE»

«APPLY PROCESS»

To do exercise 6, the students can use the technique of comparing an object with known length to an object of unknown length.

«REASONABLE VS. ABSURD»

In exercises 6-9, students should be able to eliminate some of the choices by differentiating between reasonable and absurd alternatives. This technique is useful on many tests when the method for solving a multiple-choice question is unknown.

«LOOKING BACK»

Before the students do exercise 12 ask them to estimate the answers. Emphasize that these estimates should be compared to the answers found by computation. Major discrepancies may indicate a computational error.

Other activities:

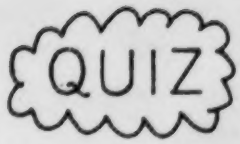
1) Students work in pairs. Each pair decides on the length or distance of 4 objects that everyone knows using each of the four common units (m, cm, mm, km).

   For example:

| | |
|---|---|
| Length of olympic-sized pool | 50 m |
| Diameter of an apple | 7 cm |
| Length of a bobby pin | 50 mm |
| Distance from Ala Moana to Downtown | 3 km |

   Students then present their examples to the rest of the class and the class chooses the two best examples for each of the units.

2) Divide the class into four groups. One group is assigned to draw (or cut out) pictures of 3 objects known to everyone. Each picture must be labeled "shorter than 1 meter," "longer than 1 meter," or "about 1 meter." The second group does the same with cm . The third group does the same with mm and the fourth group with km . Display the pictures with their labels on the bulletin board.




Quiz 1 can be given at this time. (Quiz 1 is found on page xv in the teacher's edition.)

## Pages 25 to 29 Area

Objectives: Determine area in $cm^2$ by counting squares.
Select $cm^2$ or $m^2$ as the appropriate unit for measuring area.

Problem-solving behaviors:
Clarify meaning of terms.
Explain an approach used.
Break the problem into parts.
Relate facts.
Looking back.
Look for a similar problem.
Write a mathematical sentence.
Apply another technique.

Materials: Worksheet 2, page B90

Comments: Before assigning any of these exercises, discuss the material on page 25. Have the students explain how to determine the areas of the shaded figures. Counting parts of squares and putting them together to make whole squares should be emphasized. In exercise 3, an approximation for the area can be obtained by adding the number of full squares with one-half the number of partial squares.

≪EXPLAIN APPROACH≫

Exercise 5 will be a challenge for many students. Keeping the fingers together in outlining the hand will make finding the approximate area easier. The fourth step to problem solving, Looking Back (see Mathematics Program Guide, page 15), should be emphasized here. The exercise does not ask the students for the surface area of their hand. It asks for the

≪LOOKING BACK≫

«RELATE FACTS»

surface area of their body. The students must relate the information provided with the measurement they get for their hand.

«LOOK FOR SIMILAR PROBLEMS»

Before students can solve the brainbuster, exercise 6, they must express the length and width measurements in terms of centimeters. They can then write mathematical sentences to solve the problem. Encourage students to describe their approach to the exercise. More than one technique can be used to solve it.

«APPLY ANOTHER TECHNIQUE»

The worksheet should be used to help students better understand the concepts of area and perimeter. Encourage students to discuss why the area remains constant while the perimeter varies.

Other activities:

1) Have students use grid paper and draw rectangles 2 x 3, 1 x 4, 5 x 7, etc. and discover the formula for finding area of a rectangle using base (b) and height (h). $A = b \times h$

   Do the same for finding the area of a triangle.

   Better students may be challenged to discover a formula for finding area of a trapezoid.

2) Using the geoboard, discover the formula for finding area of a polygon. The area equals one-half the number of pegs on the polygon (E) plus the number of pegs inside the polygon (i) minus one.

$$\frac{E}{2} + i - 1 = \text{Area}$$

## Pages 30 to 35 Volume

Objectives: Multiply three given dimensions to find volume.
Select $cm^3$ or $m^3$ as the best unit for finding volume.

Problem-solving behaviors:
Make a physical model.
Count.
Write a mathematical sentence.

Differentiate between reasonable and absurd.
Relate facts.
Use resources.
Extend the problem.

Materials: Centimeter cubes--32 per student
Box A, 4 cm x 5 cm x 2 cm (1 for each student)

Comments: Spend a few minutes talking about the idea of volume. Discuss the agreement of using cubes to find volume.

## WHY CUBES?

### ≪MAKE A PHYSICAL MODEL≫

Exercises 1 and 2 require the students to make physical models and to count the number of cubes in the models. These exercises are important to the development of the concept of volume. In exercise 2d, students learn to write a mathematical sentence to solve the problem. Be sure they understand the computation involved. They should not be just memorizing a formula.

### ≪WRITE A MATHEMATICAL SENTENCE≫

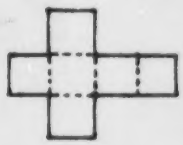
### ≪EXTEND THE PROBLEM≫

The concepts used in the brainbuster, exercise 6, can be explored and extended. Questions such as the following can be asked:

--How can you find the number of $cm^3$ in one $dm^3$?
--How many $cm^3$ are there in 2 $dm^3$?
--1 $m^3$ = ? $cm^3$
--1 $m^3$ = ? $mm^3$

Other activities:

1) Have students make a cubic centimeter with cardboard or other stiff paper.



Cut out the pattern along the solid lines. Fold along the dotted lines. Tape in place to form a cube.

2) Have students make a list of different boxes (by dimensions) having a common volume--such as 144 $cm^3$. Possibilities include:

3 cm x 6 cm x 8 cm
36 cm x 2 cm x 2 cm
12 cm x 12 cm x 1 cm

## Pages 36 to 39 Capacity

Objectives: Measure capacity of a container to the nearest unit.
Select the best approximation of a container's capacity.
Select the most appropriate unit to determine capacity of a container.

Problem-solving behaviors:
Compare.
Differentiate between appropriate and inappropriate.
Estimate.
Look for similar problem solved before.
Brainstorm.
Experiment.
Act out the problem.
Guess and check.
Record process.

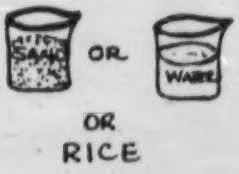
Materials: Liter measure
Graduated cylinder marked in millimeters
Water
Soda cup, juice can, milk carton, small wastepaper basket, coffee cup, soda can, mayonnaise jar

Comments:

«COMPARE»

In exercise 1, students are asked to compare measures of capacity and to relate these measurements to their uses. They apply this information to the objects listed in exercise 2. They should be able to differentiate between appropriate and inappropriate units of measurements.

«APPROPRIATE OR INAPPROPRIATE?»




For the measuring activities, sand or rice can be used in place of water. Teachers should be checking to see that good measurement techniques are used. While a few students are working at the measurement stations, other students should be working on other parts of this lesson.

«LOOK FOR SIMILAR PROBLEM»

Students who have difficulty with exercise 6 should be referred back to page 22 for help with the metric prefixes.

«BRAINSTORM»

«EXPERIMENT»

Exercise 9, the brainbuster, can be approached in a number of different ways. The problem should be brainstormed. What does the problem mean? What capacity measures can be easily found? If a 5-liter and a 3-liter measure are available, students can experiment and act

«ACT OUT THE PROBLEM»
«GUESS»
«RECORD PROCESS»

out the problem. A more common approach is to guess and then check to verify the guess. One problem students often encounter is forgetting to record the processes they use.

Other activities:

1) Have students bring to class newspaper ads where liter or milliliter is stated. Use the ads for the bulletin board display.

2) Have students look for containers whose capacity is given in metric units. Have them bring the containers to class for display in the metric corner of the classroom.

3) Label five jars--A, B, C, D, E. Put a different amount of water in each of the jars. Have students order the capacities of water from greatest to least. Students can check their answers by measuring the capacity of each jar.

## Pages 40 to 41 Mass

Objectives: Use the gram and kilogram scale to measure mass.
Select the most appropriate unit for determining the mass of an object.
Select the best approximation of the weight of an object.
Add and subtract decimal numbers.

Problem-solving behaviors:
Estimate.
Differentiate between reasonable and absurd.
Differentiate between appropriate and inappropriate.
Compute.
Guess and check.
Experiment.
Explain an approach.

Materials: Gram scale
Kilogram scale
Items to be measured: bottle, ballpoint pen, nickel, chalkboard eraser, textbooks, other objects

CLASSROOM MANAGEMENT

Comments: To keep classroom control, send students by groups of three or four to the measuring

station. Other students should be working on other parts of the lesson.

≪REASONABLE VS. ABSURD≫

≪APPROPRIATE VS. INAPPROPRIATE≫

In exercises 3 and 4 the students must differentiate between reasonable and absurd, appropriate and inappropriate.

For exercise 5, encourage students to select personal objects such as textbooks, handbag, wristwatch, comb, pen, etc. to measure.

≪ESTIMATE≫

Encourage the students to estimate the solutions to exercises 6 and 7 before they do the actual computations.

≪EXPERIMENT≫

≪GUESS AND CHECK≫

≪EXPLAIN AN APPROACH≫

The brainbuster, exercise 8, can be approached in a number of ways. Students can experiment using a physical model (if equipment is available). They can also guess and check their solutions. Students who believe they know a possible solution should attempt to explain their method to other members of the class.

Other activities:

1) Have students bring to class clippings of articles or ads that use metric mass units. Put clippings on the bulletin board. Have students bring in empty containers which give metric mass units. Display the containers in the room.

2) Have each student use the gram or kilogram scale to weigh one object that they own. The name of the object and its weight is listed on the board. Each student constructs a chart showing the mass of each object from heaviest to lightest.

## Pages 42 to 45 Capacity and Mass

Objective: Use the gram, kilogram, liter, milliliter, and their symbols.

Problem-solving behaviors:

Recall information.
Compare measures.
Differentiate between reasonable and absurd.
Estimate.
Compute.

Clarify meaning of terms.
Apply information.
Apply process used to solve a similar problem.

Materials:
Liter pitcher
Milliliter cylinder
Gram scale
Kilogram scale
Various objects to be measured.

Comments:

«COMPARE MEASURES»

These exercises provide many opportunities for students to better understand the concepts of capacity and mass. Students compare both capacity and mass.

In exercises 1 and 3, correct spelling and symbols should be stressed.

«DIFFERENTIATE BETWEEN REASONABLE & ABSURD»

In exercises 5, 6, 7, and 11, students must differentiate between reasonable and absurd measures. This should help them to reinforce their understanding of a liter and a gram. The more objects they can associate with a specific metric measure, the more likely they are to feel comfortable using that measure.

«ESTIMATE»

Have students estimate the solutions to exercise 8 before computations are done.

«CLARIFY MEANING OF TERMS»

The text on page 44 should help to clarify the meaning of the term "mass." It is also intended to help the student differentiate between the meanings of weight and mass.

**REVIEW ROUNDING**

«APPLY PROCESS USED TO SIMILAR PROBLEM»

You may want to discuss the table in exercise 9 before assigning it. Also, students may need a review of rounding to the nearest gram and rounding to the nearest kilogram for exercise 10. Students should apply the process used in exercise 9 to solve exercise 10.

Other activities:

1) Have students write their favorite gelatin or punch recipe using metric units.

2) Have students operate a "guess your weight" booth at the school fair or as a school activity for Metric Week.

QUIZ

Quiz 2 can be given at this time. (Quiz 2 can be found on page xvi in the teacher's edition.)

## Pages 46 to 49 Temperature

Objectives: Read temperatures on a clinical and non-clinical thermometer.
Know the temperature for freezing point of water, boiling point of water, usual temperature in Hawaii, and normal body temperature.
Select the temperature which is the best approximation of a situation.

Problem-solving behaviors:
Apply information.
Record data.
Draw a figure.
Estimate.
Differentiate between reasonable and absurd.

Materials: Celsius thermometers
Ice cubes
Dish

Comments:

≪APPLY INFORMATION≫

Exercise 1 requires the students to apply information provided in the diagram on page 46.

The Celsius thermometers for classroom use will not show normal body temperature as 37° C. Explain that the clinical thermometer is used for this purpose.

≪RECORD DATA≫

Exercises 2 and 3 on page 47 have the students record data in two different ways.

PLAN AHEAD

So that students can measure the temperature of a dish of ice cubes (exercise 1, page 48), the teacher may need to bring ice cubes in a thermos. To save time, the thermometer may be placed in the glass of water and dish of ice cubes before class begins.

Other activity:
Have students take the outside temperature reading at the same time each day for 20 days. Make a line graph to record their findings.

## Pages 50 to 51 Conversions

Objective: Convert a metric measurement to another specified metric unit.

Problem-solving behaviors:
Look for patterns.
Compute.
Check your result for reasonableness.
Generalize a solution process.
Apply the process used to solve similar problems.

Materials: None

Comments: Before students begin this section discuss patterns they have noticed when comparing metric units in earlier sections. Ask questions such as:

--If you measure something in both liters and centiliters, which number will be larger?

«LOOK FOR PATTERNS»

--What do you notice about these numbers?

6 cm = 60 mm
12 cm = 120 mm
3.5 cm = 35 mm
2.75 cm = 27.5 mm

--Repeat second question using examples with grams and dekagrams, centiliters and liters, and so on.

Once students can verbalize the patterns in these conversions, have them turn to page 50. Ask how the chart at the top of the page has been organized. Go over the examples provided and discuss why this process works. Why does the decimal point move three places to the left when converting from liters to kiloliters?

«GENERALIZE THE PROCESS»

«APPLY PROCESS TO SIMILAR PROBLEMS»

Students are now ready to apply this process to the remaining exercises. They should find it easier to convert by counting the number of places rather than by carrying out multiplication or division by powers of ten. Conversion between systems is not recommended.

**DON'T CONVERT BETWEEN SYSTEMS!**

## Pages 52 to 53 Metric Mania

Objective: Identify metric terms and common metric prefixes through game activities.

Problem-solving behaviors:
Identify vocabulary.
Decode information.
Apply a process.
Compute.
Follow directions.
Guess and check.
Analyze results.

Materials: None

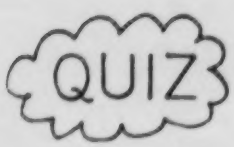
Comments: These activities provide for a change-of-pace and some review. The teacher may wish to conduct a short question-and-answer period.

≪FOLLOW DIRECTIONS≫

≪GUESS AND CHECK≫

≪ANALYZE RESULTS≫

In exercise 4 it is important that students read and understand the directions before completing the table. Students may begin to solve this puzzle by guessing and then checking to see if their guesses are correct. When a guess is incorrect the sums should be analyzed. If the sum is too small in one row and too large in a column, can numbers be repositioned to give the correct result? What effect does changing these numbers have on the remaining rows and columns?




Quiz 3 can be given at this time. (Quiz 3 can be found on page xvii in the teacher's edition.)

## Pages 54 to 55 Do You Know?

Objective: Review the highlights of Learning about the Metric System in High School.

Problem-solving behaviors:
Recall information.
Compare units of measurement.
Compute.

Materials: None

Comments: These pages serve as a self-check on most of the objectives of the booklet. They can be used as a classroom review lesson or can be assigned as homework with time

set aside for a short discussion on the following day prior to the posttest.

The unit test can be given at this time. You will need 5 items for the students to measure in items 46-50. Some students should begin with these exercises so that congestion can be avoided. Duplicate items would be helpful. (The Posttest can be found on pages xix-xxii in the teacher's edition.)

Page B89 Worksheet 1: Pizza Party

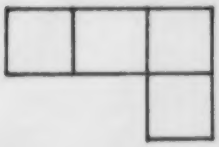
1-10. Answers will vary. (1-3, 5-7: Be sure these check)

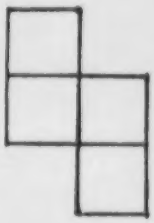
Page B90 Worksheet 2

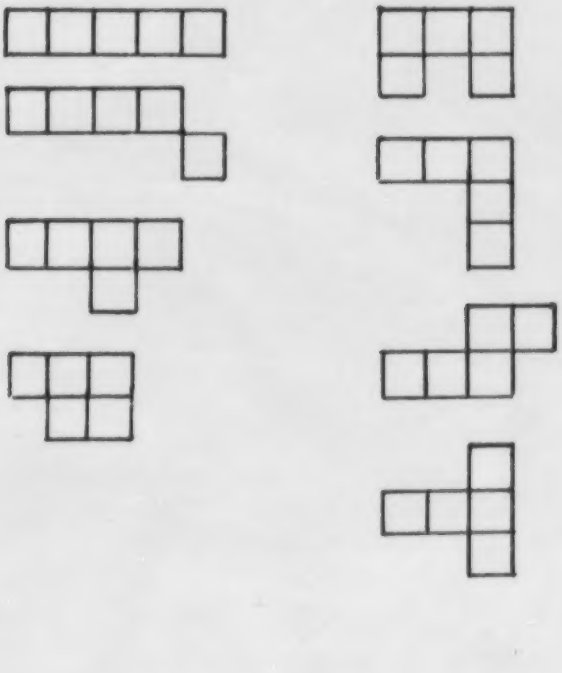
1. a. A = 4 sq. cm
P = 8 cm

b. A = 4 sq. cm
P = 10 cm

c. A = 4 sq. cm
P = 10 cm

2. a. 
A = 4 sq. cm
P = 10 cm

b. 
A = 4 sq. cm
P = 10 cm

3. a. 

b. 12 c. area; perimeter d. 12 cm e. 10 cm

# MASTERS FOR WORKSHEETS AND TRANSPARENCIES

Sampling and Statistics Name _____

Ratio and Percent Review I Date _____

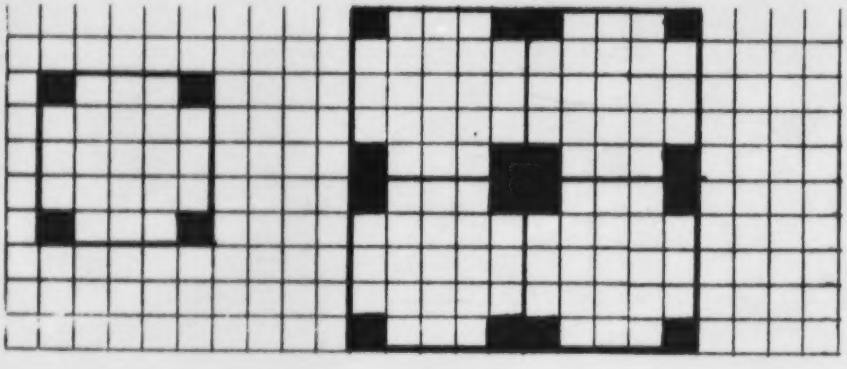
Directions: Use grid paper provided for the following problems. An example is given for you to follow.

Example:

4 out of 25

16 out of 100

So, $\frac{4}{25}$ = 16%



1. 16 out of 20

___ out of 100

So, $\frac{16}{20}$ = ___%

2. 21 out of 25

___ out of 100

So, $\frac{21}{25}$ = ___%

3. 8 out of 10

___ out of 100

So, $\frac{8}{10}$ = ___%

4. 3 out of 4

___ out of 100

So, $\frac{3}{4}$ = ___%

5. 2 out of 5

___ out of 100

So, $\frac{2}{5}$ = ___%

6. 9 out of 25

___ out of 100

So, $\frac{9}{25}$ = ___%

7. 9 out of 20

___ out of 100

So, $\frac{9}{20}$ = ___%

8. 6 out of 8

___ out of 100

So, $\frac{6}{8}$ = ___%

9. 12 out of 15

___ out of 100

So, $\frac{12}{15}$ = ___%

10. 6½ out of 10

___ out of 100

So, $\frac{6\frac{1}{2}}{10}$ = ___%

11. 12 out of 30

___ out of 100

So, $\frac{12}{30}$ = ___%

12. 1 out of 3

___ out of 100

So, $\frac{1}{3}$ = ___%

Sampling and Statistics

Ratio and Percent Review II

Name _____

Date _____

1. 10% means

10 out of every 100
5 out of every 50
1 out of every 10
9 out of every _____
_____ out of every _____

So, 10% of 100 is _____
10% of 50 is _____
10% of _____ is 9
10% of _____ is _____

2. 25% means

25 out of every 100
1 out of every _____
_____ out of every 20
_____ out of every 92
_____ out of every _____

So, 25% of 100 is _____
25% of _____ is 1
25% of 20 is _____
25% of 92 is _____

3. 100% means

100 out of every 100
1 out of every _____
_____ out of every _____

So, 100% of 100 is _____
100% of _____ is 1

4. 50% means

50 out of every 100
1 out of every _____
_____ out of every 50
17 out of every _____
_____ out of every _____

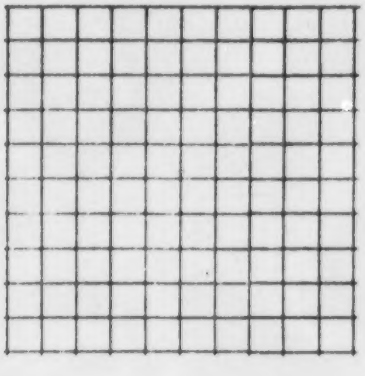
So, 50% of 100 is _____
50% of _____ is 1
50% of 50 is _____
50% of _____ is 17
50% of _____ is _____

5. Now you do one.

_____% means

_____ out of every _____
_____ out of every _____
_____ out of every _____

So, _____% of _____ is _____
_____% of _____ is _____
_____% of _____ is _____



Sampling and Statistics

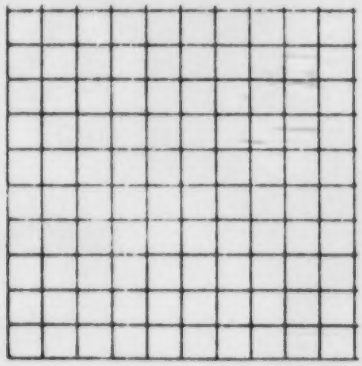
Ratio and Percent Review III

Name _____

Date _____

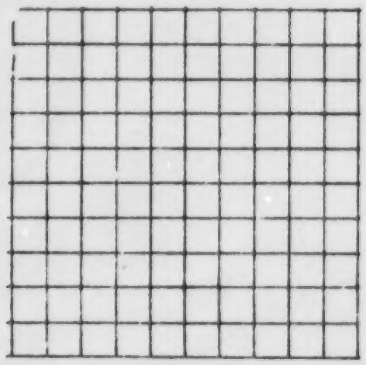
1. Shade 30% of the grid below.

_____ out of 100



2. Shade 15% of the grid below.

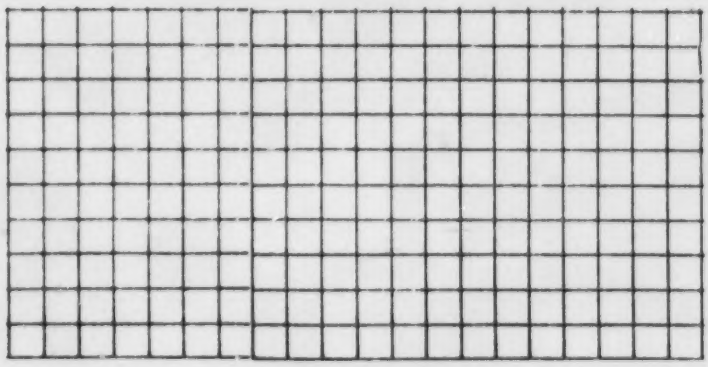
_____ out of 100



3. Shade 25% of the grid below.

_____ out of 100 or

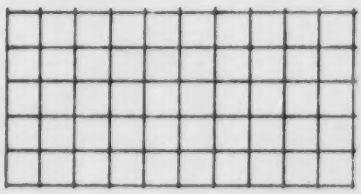
_____ out of 200



4. Shade 50% of the grid below.

_____ out of 100

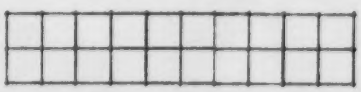
_____ out of _____



5. Shade 80% of the grid below.

_____ out of 100

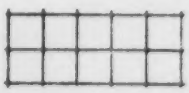
_____ out of 20



6. Shade 80% of the grid below.

_____ out of 100

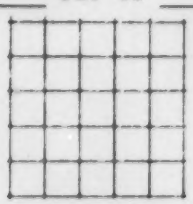
_____ out of _____



7. Shade 60% of the grid below

_____ out of 100

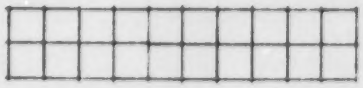
_____ out of _____



8. Shade 5% of the grid below

_____ out of 100

_____ out of _____



9. Shade 25% of the grid below

_____ out of 100

_____ out of _____

Sampling and Statistics

Name _____

Comparing Ratios

Date _____

To the student:

Ratios are often expressed as percents. Percent means per 100. For instance, 20% means 20 per 100 (or 20 out of 100). This makes it easier to compare ratios. Look at the example below.

Who had the better test score?

Stan: 15 correct out of 25 problems
Jack: 26 correct out of 40 problems

It would be much easier to compare the test scores using percents:

Stan: 60% correct
Jack: 65% correct

Jack's percent correct shows that he had the better score.

Directions: Work on a separate sheet. Write each ratio as a percent, then answer the question.

1. Which is the better score?

   Test 1: 15 out of 25 correct.
   Test 2: 12 out of 18 correct.

2. Who is the better batter?

   Stan: 6 hits out of 10 tries.
   Mark: 4 hits out of 6 tries.

3. Who had the better pass completion ratio?

   Jack: 12 completions out of 40 passes.
   Eric: 8 completions out of 24 passes.

4. Who got the best score?

   Tom: 21 correct out of 25 problems
   Dick: 17 correct out of 20 problems
   Harry: 12 correct out of 16 problems

5. Which class had the best turnout?

   9th: 18 out of 25
   10th: 21 out of 30
   11th: 24 out of 32
   12th: 28 out of 40

6. Who is the best free throw shooter?

   Patrick: 12 baskets out of 25 tries
   John: 28 baskets out of 35 tries
   Jay: 30 baskets out of 40 tries.

Sampling and Statistics

Name _____

Identifying Facts

Date _____

Directions: Read each problem on the left. Answer the question to its right. (DO NOT ANSWER QUESTION ON THE LEFT.)

| | |
|---|---|
| 1. Tom scored 81, 80, 77 and 90 points on different math tests. What was his average score? | What was Tom's highest score?<br>a. 77<br>b. 80<br>c. 81<br>d. 90 |
| 2. Bill's baseball batting average is .316. John's is .263. How much higher is Bill's batting average than John's? | What is John's baseball batting average?<br>a. .053<br>b. .263<br>c. .316<br>d. .589 |
| 3. Kate has a garden in the shape of a rectangle that is 12 feet wide and 17 feet long. What is the perimeter of her garden? (p = 2 x w + 2 x l) | What is the length of Kate's garden?<br>a. 12<br>b. 17<br>c. 29<br>d. 58 |
| 4. John's pack with two cans of juice weighs 7310 grams. Each can of juice weighs 850 grams. How many grams will Jim's pack weigh after he takes out one can of juice? | How much does one can of juice weigh?<br>a. 1 gram<br>b. 2 grams<br>c. 850 grams<br>d. 7310 grams |
| 5. Last November 23rd some students at Manoa High School went on a field trip. There were 425 students remaining in school. 15% of the students were absent or on the field trip. How many students are enrolled at Manoa High School? | How many students were absent or on the field trip on November 23rd?<br>a. 15 students<br>b. 23 students<br>c. 425 students<br>d. problem doesn't say |

(Go on to the next page.)

6. Shirley and Ellen went on diets. On May 1st Shirley weighed 134 pounds and Ellen weighed 128 pounds. Two months later Shirley weighed 119 pounds and Ellen weighed 125 pounds. How much weight did Shirley lose?

What does 128 represent?

a. Shirley's weight before the diet
b. Ellen's weight before the diet
c. Shirley's weight after the diet
d. Ellen's weight after the diet

7. Optional Sales Tax Table

| Income [1] | Hawaii | | | | |
|---|---|---|---|---|---|
| | Family size (persons) | | | | |
| | 1 | 2 | 3&4 | 5 | Over 5 |
| Under $3,000 | $80 | $87 | $91 | $101 | $101 |
| $3,000–$3,999 | 85 | 105 | 111 | 123 | 123 |
| $4,000–$4,999 | 99 | 120 | 129 | 143 | 144 |
| $5,000–$5,999 | 112 | 135 | 145 | 161 | 163 |
| $6,000–$6,999 | 123 | 148 | 159 | 178 | 181 |
| $7,000–$7,999 | 134 | 160 | 173 | 193 | 198 |
| $8,000–$8,999 | 145 | 172 | 186 | 208 | 215 |
| $9,000–$9,999 | 155 | 183 | 199 | 222 | 230 |
| $10,000–$10,999 | 165 | 193 | 211 | 236 | 245 |
| $11,000–$11,999 | 174 | 203 | 222 | 249 | 260 |
| $12,000–$12,999 | 183 | 213 | 233 | 261 | 274 |
| $13,000–$13,999 | 192 | 222 | 244 | 273 | 287 |
| $14,000–$14,999 | 200 | 231 | 254 | 285 | 300 |
| $15,000–$15,999 | 208 | 240 | 264 | 296 | 313 |
| $16,000–$16,999 | 216 | 248 | 274 | 307 | 326 |
| $17,000–$17,999 | 224 | 256 | 284 | 318 | 338 |
| $18,000–$18,999 | 232 | 264 | 293 | 329 | 350 |
| $19,000–$19,999 | 239 | 272 | 302 | 339 | 362 |

What does the 222 in the box represent?

Sales tax deduction for:

a. family of 2 earning $11,500
b. family of 3 & 4 earning $11,500
c. family of 2 earning $12,000
d. family of 3 & 4 earning $13,000

8.

**SELECTED TOYS**

107 only! Choose from Nerf® cars, trucks, Lego® police units and Sesame St. figures.

Orig. 2.79-4.49

**NOW 88¢**

What does the 107 represent?

a. The sale price of the toys
b. The regular price of the toys
c. The number of toys on sale
d. None of the above

9.

**Replacement Dinette Chairs**

All have strong tubular steel frames and easy-care vinyl cushion covers

**Cut $5** Carton of 2 was ~~$39.95~~

Your Choice (A thru D) **2** in a carton **$34.88**

What does the amount $34.88 represent?

a. The sale price of two replacement chairs
b. The regular price of two replacement chairs
c. The amount of discount
d. None of the above

Sampling and Statistics

Relating Facts

Name _____

Date _____

Directions: Read each problem on the left. Answer the question to its right. (DO NOT ANSWER QUESTION ON THE LEFT.)

| | |
|---|---|
| 1. Dave can run 2½ times faster than Jack. Jack can run 1½ times faster than Jerry. How much faster can Dave run than Jerry? | The fastest runner is:<br>a. Dave<br>b. Jack<br>c. Jerry<br>d. Problem doesn't say |
| 2. Michael went shopping for clothes on Saturday. He bought 3 shirts that cost $21.95 each; 2 pairs of pants at $19 each; and a pair of shoes for $39.95. How much money did he spend that day? | The total cost of the shirts is:<br>a. $21.95<br>b. $19<br>c. $43.90<br>d. $65.85 |
| 3. The school auditorium contains 800 seats. The drama club plans to sell tickets at $3 and $2, depending on the view of the stage. There are 550 seats in the better section. How much money will the club make if they sell all their tickets? | The number of seats in the $2 section is:<br>a. 250<br>b. 550<br>c. 800<br>d. 1350 |
| 4. Grace is secretary of her club. She must mail copies of the club newsletters to each of 852 members. She has 6 boxes of envelopes. Each box contains 175 envelopes. Does she have enough envelopes for this mailing? | The total number of envelopes that Grace has is:<br>a. 6<br>b. 175<br>c. 852<br>d. 1050 |

(Go on to the next page.)

5.

# TIME CARD

Name Steven Brooks 123 45-6789

Dept. Advertising

Hourly Rate $3.60

Week Ending September 29

| | In AM | Out AM | In PM | Out PM | Total Hrs. |
|---|---|---|---|---|---|
| MON | 8:00 | 12:00 | 12:30 | 4:30 | 8 |
| TUES | 9:00 | 12:30 | 1:00 | 5:30 | |
| WED | 8.00 | 12:15 | 12:45 | 5:00 | |
| THURS | 8:45 | 12:45 | 1.15 | 4:30 | |
| FRI | 8:45 | 12:15 | 12:45 | 4:45 | 7½ |

The total number of hours Steven worked:

I. Tuesday morning is:

a. 2½ hours
b. 3 hours
c. 3½ hours
d. 4 hours

II. All Day Wednesday is:

a. 8 hours
b. 8⅓ hours
c. 8½ hours
d. 9 hours

6.

HAWAII WEATHER ROUNDUP

| Weather and Temperature at 7 a.m. today | | Yesterday's High | Yesterday's Low |
|---|---|---|---|
| Honolulu Airport, cloudy | 75 | 87 | 73 |
| Barbers Pt. NAS, partly cloudy | 72 | 88 | 71 |
| Wheeler AFB, partly cloudy | 70 | — | 65 |
| Kaneohe MCAS, partly cloudy | 70 | 87 | 70 |
| Lihue Airport, partly cloudy | 77 | 86 | 73 |
| Molokai Airport, partly cloudy | 73 | 87 | 72 |
| Kahului Airport, partly cloudy | 77 | 90 | 74 |
| Hilo Airport, cloudy | 73 | 83 | 71 |
| Kona Airport, partly cloudy | — | — | — |

I. Yesterday the difference between the high and low temperatures at Hilo airport was:

a. 87 - 73
b. 88 - 71
c. 83 - 71
d. 83 - 72

II. Yesterday the airport that had the greatest difference in temperature was:

a. Honolulu Airport
b. Barbers Pt. NAS
c. Molokai Airport
d. Kahului Airport

Sampling and Statistics Name _____

Relating Facts Logically Date _____

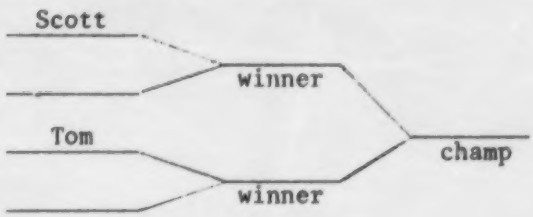
1. Scott, Tom, Jill and Faith play in a ping pong tournament. For the first game, they played boy against girl. Use the hints below to fill in the diagram to find the champ.

   a. Jill lost her first game.

   b. Tom won his first game.

   c. Scott never defeated either girl.

   d. Faith was not the champ.




2. Ron, Shirley and Ann are 10th, 11th and 12th graders, not necessarily in that order. Ann and the 10th grader are neighbors. Shirley thinks she's in love with the boy in the 12th grade. What grades are they in?

| | R | S | A |
|---|---|---|---|
| 10th | | | |
| 11th | | | |
| 12th | | | |

3. Dave, John and Mark play for their school's football, basketball and volleyball teams, not necessarily in that order. Use the following hints to determine what Dave plays.

   a. Dave and the football player went surfing together.

   b. Mark and the volleyball player have lunch together in school.

   c. John is the starting quarterback.

| | | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

4. Five students in Mr. Yoshino's class have dogs. Ann, Bob, Carol, Dave, and Ed each have one dog. Their dogs' names are Inky, Max, Pepper, Kurly, and J-R. Using the information below, determine which dog belongs to each student.

   a. Ann doesn't own Pepper or Kurly.

   b. Bob doesn't own Pepper.

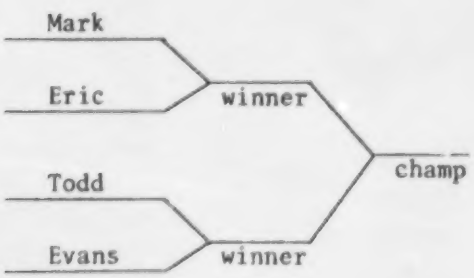
   c. Dave owns J-R.

   d. Ed owns either Inky or J-R.

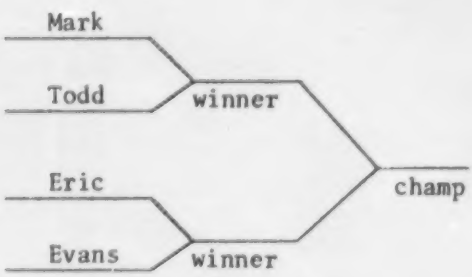
| | A | B | C | D | E |
|---|---|---|---|---|---|
| I | | | | | |
| M | | | | | |
| P | | | | | |
| K | | | | | |
| J-R | | | | | |

*5. Mark, Eric, Todd, and Evans played in three tennis tournaments. Eric never defeated Evans. Mark lost all of his games. Evans never defeated Todd. Only Mark did not win a championship. Can you complete the three sets below?

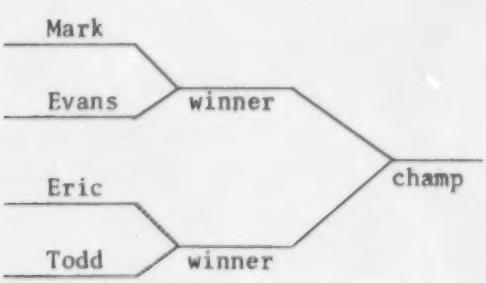
Tournament 1




Tournament 2




Tournament 3



TOSHI BOUGHT FIVE RECORD ALBUMS TO GIVE AS GIFTS TO MAINA, KENRICK, FRED, DONNA AND PAT. ONE IS A HOMEGROWN ALBUM; THE OTHERS ARE BY THE BEE-GEES, BROTHERS CAZIMERO, SHAUN CASSIDY AND ELVIS PRESLEY. (NO ONE WAS TO RECEIVE AN ALBUM THEY ALREADY HAD AND EVERYONE LIKED THE ALBUM THEY RECEIVED.) WHO RECEIVED WHICH ALBUM FROM TOSHI?

| | BEE-GEES | HOMEGROWN | BROTHERS CAZIMERO | SHAUN CASSIDY | ELVIS PRESLEY |
|---|---|---|---|---|---|
| MAINA | | | | | |
| KENRICK | | | | | |
| FRED | | | | | |
| DONNA | | | | | |
| PAT | | | | | |

A. KENRICK AND DONNA ALREADY HAVE THE HOMEGROWN ALBUM.

B. FRED AND THE PERSON WHO RECEIVED THE BEE-GEES ALBUM DON'T LIKE SHAUN CASSIDY.

C. MAINA RECEIVED THE ELVIS PRESLEY ALBUM.

D. TOSHI BOUGHT EITHER THE BEE-GEES OR THE SHAUN CASSIDY ALBUM FOR PAT.

E. DONNA RECEIVED AN ALBUM RECORDED BY A SINGLE ARTIST.

B-4 Honolulu Star-Bulletin Monday, June 11, 1979

# Get Ready to Stand Up and Be Counted

WASHINGTON—If you live in a small town, they're interested.

If you ride with a friend to work, they're interested.

But if you insulated your home last year, they don't care.

And if you're homosexual, that's your business.

The Census Bureau has been counting noses in the United States every 10 years since 1790, and next April an army of 275,000 people will do it again.

But the decennial census is far more important than just a nose count. In fact, the Census Bureau has a pretty good idea already of how many people live in the United States—222 million.

It is far more interested in where we live, how we earn our living, how frequently we've moved and who we are.

To gather this data, it has been holding practice censuses for the last 10 years. And it is prepared to spend $1 billion next year—$4 for every man, woman and child—to complete the job, four times what it spent in 1970.

A lot is at stake.

FEDERAL AGENCIES use Census Bureau data for everything from energy planning to deciding what areas need public housing.

The 1980 census is expected to be proof-positive of the importance of America's minority populations and the growing importance of women as bread winners.

And Congress will gather the census material for distribution to the state legislatures so they may accordingly reapportion the 435 House seats in time for the 1982 elections.

And, to keep the workload manageable, it will do a detailed count of only 22 percent of us—with a 65-question long form—leaving the rest to fill out a 22-question short form. For those who fail to mail their forms (postage-free) to the Census Bureau's local offices by April 1, 1980, there will be follow-up phone calls and visits by census takers. It is against the law to refuse to participate in the census, although many people protest that questions on the census forms invade their privacy.

THE CENSUS Bureau was criticized for undercounting minorities in the 1970 count, particularly after big-city mayors and ethnic minority leaders discovered how important the count was to receive federal funds with the start of revenue sharing by the Nixon administration.

Marshall Turner, assistant chief of the decennial census division, freely admits the undercount, but defends the Census Bureau as among the most accurate in the world.

"In 1970, we missed 2.5 percent of the over-all population," he said, either because the census takers miss houses or because people won't answer the census. Many persons fear the census material will be given to other government agencies, like the FBI or social service agencies, despite denials by the Census Bureau.

One sensitive minority issue will be skirted next year by allowing individuals to determine for themselves if they are a member of a minority. This is [illegible] crucial for Hispanic [illegible] not only go by different [illegible] in various sections of the country, but vary as to whether they wish to be counted as Hispanics. Accordingly, the 1980 forms will leave the question to their discretion, as it will be Asian-Americans, Indians, blacks and other minorities.

TO TRY TO correct the 1970 undercount and test new questions, the Bureau has run a 1980 pre-census in five cities: Austin, Tex., Camden, N.J., Oakland, Calif., New York City (Manhattan), and Richmond, Va.

Oakland, a predominantly black city, was tested two years ago, and spot checks of housing units—its biggest concern—showed a high degree of accuracy, according to Alex Zuckerman, a city planner.

"They're always going to have some problems because there's a lack of trust in government and people won't answer," he said. "But we feel it went well."

The Census Bureau is pressured by a variety of special interest groups and federal agencies to include questions of interest to them. Most get turned down.

For instance: Homosexual civil rights groups wanted a "sexual preference" question on this year's form, but the Bureau decided the question would offend too many people to include. "We're trying to encourage people to answer, not turn them away," Turner said.

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## Dealing Pairs

Instructions:

1. Choose a dealer and a recorder.
2. Dealer: a) Shuffle cards well. Be careful not to return pairs together to the deck. (Why?)
   b) Deal out 10 hands of 5 cards each (you should have 2 left).
3. Others: Keep track of the number of hands that contain at least one pair.
4. Recorder: Tally results in table below.
5. Repeat experiment 5 times, choosing a new dealer and recorder.

| | Tally of hands with pairs | Number | Ratio | Percent |
|---|---|---|---|---|
| Experiment 1 | | | $\frac{\quad}{10}$ | |
| Experiment 2 | | | $\frac{\quad}{10}$ | |
| Experiment 3 | | | $\frac{\quad}{10}$ | |
| Experiment 4 | | | $\frac{\quad}{10}$ | |
| Experiment 5 | | | $\frac{\quad}{10}$ | |
| Total | | | $\frac{\quad}{50}$ | |

Questions for discussion:

1. What percent of your hands contained at least one pair?
2. Is this similar to other groups?
3. Can you come to any conclusion?

## Can You Guess the Color?

Instructions:

1. Look at your sample.
2. Guess the color that is most common in your sample _____.
3. Fill in the table below (tally) according to the colors in your sample.
4. Write in your colors first. Then begin to tally.

| Color | Tally | Number | Ratio | Percent |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Total | | | | |

5. What color was most common? _____

6. What color was least common? _____
7. Compare your results with others.
8. Now you don't need your samples any more.
9. Fill in your class data and complete the table below.

| Color | Number | Ratio | Percent |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Total | | | |

Questions for discussion:

1. Compare your result with the class result.
   a. Are they alike? different? how?

2. What do you think the composition of a large bag of this sample would be?

Sampling and Statistics

Name _____

What is Your Last Initial?

Date _____

| Initial of Last Name | SAMPLE CLASS Tally | Frequency | Ratio | Percent | YOUR CLASS Tally | Frequency | Ratio | Percent |
|---|---|---|---|---|---|---|---|---|
| A-B | | 6 | $\frac{6}{30}$ | 20% | | | | |
| C-D | | 5 | $\frac{5}{30}$ | 17% | | | | |
| E-F | | 2 | | | | | | |
| G-H | | 2 | | | | | | |
| I-J | | 1 | | | | | | |
| K-L | | 1 | | | | | | |
| M-N | | 4 | | | | | | |
| O-P | | 1 | | | | | | |
| Q-R | | 2 | | | | | | |
| S-T | | 4 | | | | | | |
| U-V | | 0 | $\frac{0}{30}$ | 0% | | | | |
| W-X | | 2 | | | | | | |
| Y-Z | | 0 | | | | | | |
| Total Number of Students | | 30 | | 100% | | | | |

Discussion Questions:

1. What is the most common pair(s) of initials for the sample class? Your class?

2. What is the least common pair(s) of initials for the sample class? Your class?

3. In comparing the two groups, why is it easier to use percents instead of ratios?

4. Suppose we had tallied each initial separately. How would this change the results?

Sampling and Statistics Name _____

Finding Patterns I Date _____

Directions: Finding patterns is a strategy that is often used in problem solving. Study the patterns below and fill in the blanks to continue each pattern. Then write the rule used. The first rule is written for you.

1. 5, 9, 13, 17, 21, _____, _____, _____, _____, 41, . . .

   Rule: *Add 4*

2. 3, 6, 12, 24, _____, _____, 192, . . .

   Rule: _____

3. 1, 2, 4, 7, 11, _____, _____, _____, _____, 46, . . .

   Rule: _____

4. 124, 123, 121, 118, 114, _____, _____, _____, 88, . . .

   Rule: _____

5. 2-1/2, 2-3/4, 3, _____, _____, _____, 4, . . .

   Rule: _____

6. 15, 5, 5/3, 5/9, _____, _____, _____, 5/729, . . .

   Rule: _____

Sometimes the pattern involves more than one number. Try these!

7.

| x | 4 | 5 | 6 | 7 | | | 10 | | 12 |
|---|---|---|---|---|---|---|---|---|---|
| y | 8 | 7 | 6 | | 4 | 3 | | 1 | |

Rule: _____

8.

| p | 12 | 10 | 7 | 20 | 19 | 3 | 0 | | 2.1 |
|---|---|---|---|---|---|---|---|---|---|
| r | 17 | 15 | 12 | 25 | | | | 14 | |

Rule: _____

9.

| e | 3.8 | 4 | 8.1 | 9.6 | | 3.1 | 6.81 | | 6 | 3.01 |
|---|---|---|---|---|---|---|---|---|---|---|
| f | 2.7 | 2.9 | 7 | 8.5 | 2.6 | | | 12.2 | | |

Rule: _____

10. The bus driver of the Wahiawa-Kaneohe bus noticed that passengers were boarding his bus in an unusual way. At the first stop, 1 passenger boarded. At the second stop 3 people boarded Then 5 at the third stop, 7 at the 4th, etc. The table on the right organizes this information. Assuming this pattern continues, the bus driver wants to know how many passengers will be on the bus after 25 stops. He is also interested in knowing when the bus will be full if it can only hold 81 passengers.

| STOP NO. | NO. OF PEOPLE BOARDING | TOTAL NO. PASSENGERS |
|---|---|---|
| 1 | 1 | 1 |
| 2 | 3 | 4 |
| 3 | 5 | ☐ |
| 4 | 7 | ☐ |
| 5 | ☐ | ☐ |
| 6 | ☐ | ☐ |
| ⋮ | ⋮ | ⋮ |
| ☐ | ☐ | 81 |
| ⋮ | ⋮ | ⋮ |
| 25 | ☐ | ☐ |

a. Complete as much of the table as you can.

b. Describe the pattern in the second column.

c. Describe the pattern in the third column.

d. Look at the numbers in the first column and compare them to the numbers in the third column. What relationship do these numbers have?

e. Use the relationship you found in (d) to fill in the ☐ in column one and the ☐ in column three.

*f. Look at the numbers in the first column and compare them to the numbers in the second column. What relationship do these numbers have?

*g. Use the relationship you found in (f) to fill in the ☐'s in the second column.

*These should be done as a class activity.

Sampling and Statistics

Finding Patterns II

Name _____

Date _____

Look at the following tables. Can you find a pattern to fill in the blank spaces?

1.

| x | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| y | 0 | 1 | 2 | | | | | | | | | | |

2.

| H | 1 | 3 | 5 | 6 | 7 | 9 | 11 | |
|---|---|---|---|---|---|---|---|---|
| M | 6 | 18 | 30 | | | | | 96 |

3.

| a | 8 | 6 | 2 | 1 | | 3 | 11 | $1\frac{1}{2}$ | 9 |
|---|---|---|---|---|---|---|---|---|---|
| b | 4 | 3 | 1 | | $\frac{1}{3}$ | | | | |

4.

| a | 7 | 6.8 | 8.5 | | | 8.93 | | | 14.72 | 9.08 |
|---|---|---|---|---|---|---|---|---|---|---|
| b | 4.3 | 4.1 | 5.8 | 6 | .6 | | 1.01 | 2.2 | | |

5. The Class of '81 is having a picnic. People arrived in an interesting manner. The advisor arrived first by himself. Three people arrived in the second vehicle 5 people in the third, 7 people in the fourth and so on. The table shows this information. Fill in the boxes provided.

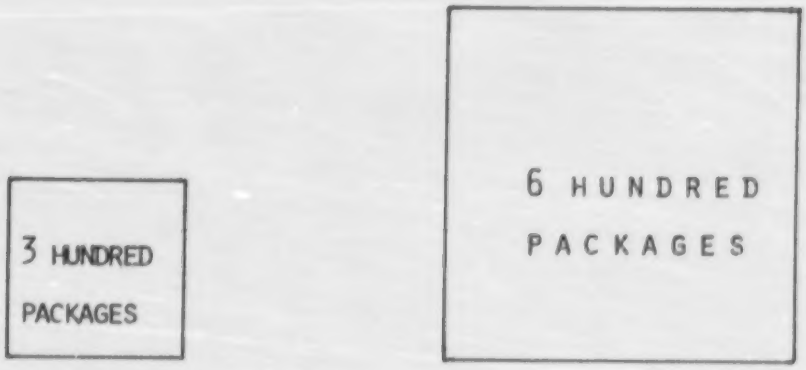
HINTS:
(1) Do you notice a pattern in the second column?
(2) Do you notice a pattern in the third column?
(3) What relationship is there between the numbers in column 1 and column 3?
(4) What relationship is there between the numbers in column 1 and column 2?

| Vehicle | Number of People in Vehicle | Total Number at picnic |
|---|---|---|
| 1 | 1 | 1 |
| 2 | 3 | 4 |
| 3 | 5 | 9 |
| 4 | 7 | ☐ |
| 5 | ☐ | ☐ |
| 6 | ☐ | ☐ |
| 7 | ☐ | ☐ |
| . | . | . |
| . | . | . |
| . | . | . |
| ☐ | ☐ | 100 |
| . | . | . |
| . | . | . |
| . | . | . |
| 25 | ☐ | ☐ |

VISUAL A

# GREEN THUMB PLANT SHOP

## SEED SALES

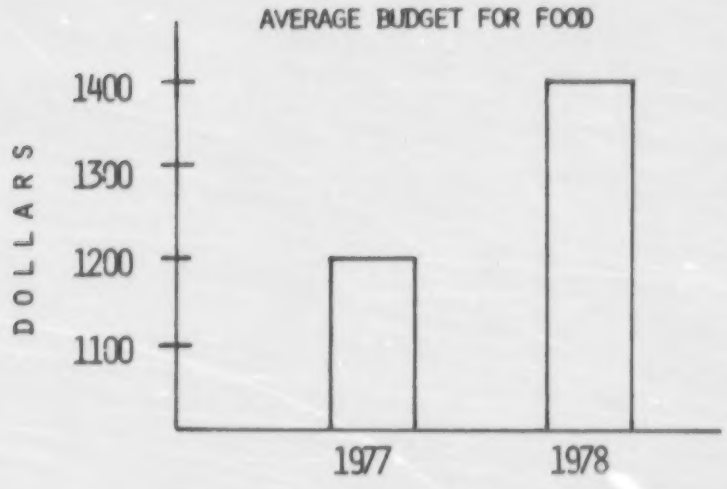



1970 1975

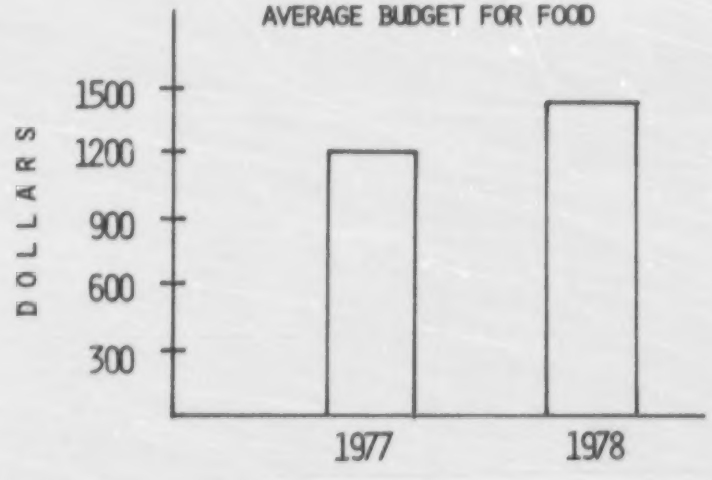
1970 PLANT SEEDS PLANT SEEDS PLANT SEEDS

1975 PLANT SEEDS PLANT SEEDS PLANT SEEDS PLANT SEEDS PLANT SEEDS PLANT SEEDS

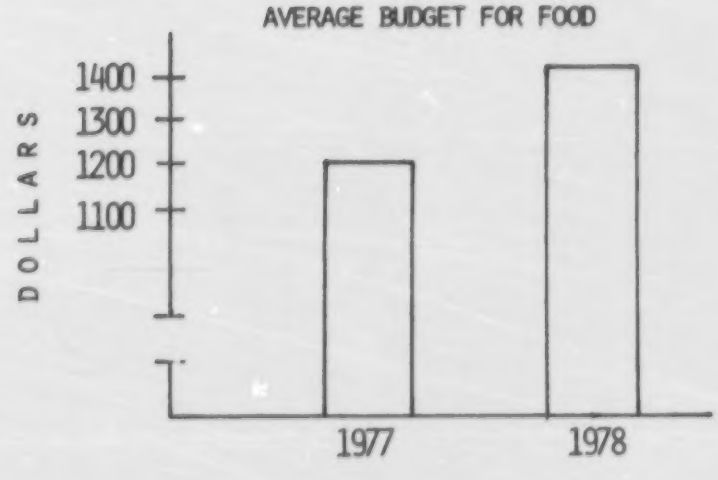
PLANT SEEDS = 100 PACKAGES OF SEEDS

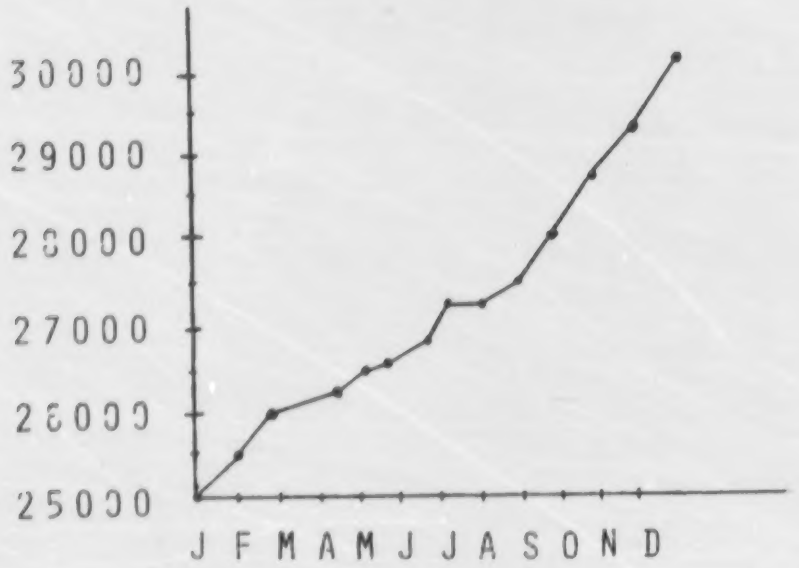

AVERAGE BUDGET FOR FOOD
DOLLARS
1400
1300
1200
1100
1977
1978

---

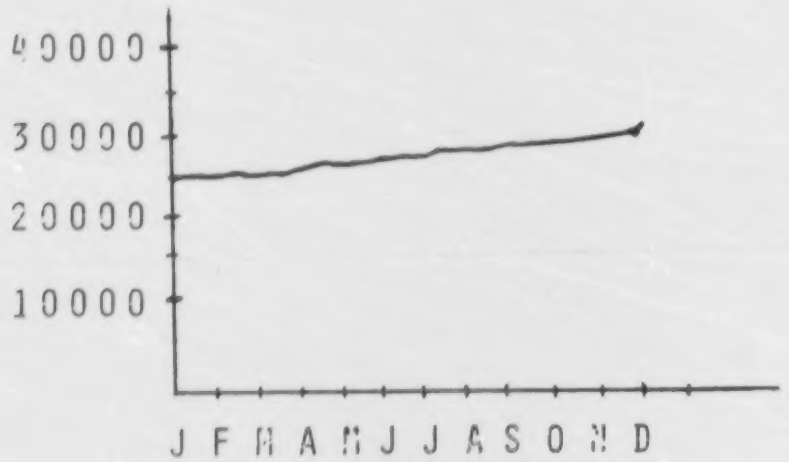

AVERAGE BUDGET FOR FOOD
DOLLARS
1500
1200
900
600
300
1977
1978

Q B


AVERAGE BUDGET FOR FOOD
DOLLARS
1400
1300
1200
1100
1977
1978




1973 Income of Green
Thumb Plant Shop




1978 Income of Green
Thumb Plant Shop

# WHAT IS THE MEDIAN?

1. 3, 6, 2, 5, 3

2. 6, 8, 10, 12, 14, 16

3. $40,000
   $20,000
   $10,000
   $10,000
   $10,000

4. $40,000
   $10,000
   $10,000
   $20,000
   $ 8,000
   $20,000

5.

| Wages | Frequency |
|---|---|
| $10,000 | 3 |
| $20,000 | 1 |
| $40,000 | 1 |

6.

| Wages | Frequency |
|---|---|
| $40,000 | 1 |
| $20,000 | 2 |
| $10,000 | 2 |
| $ 8,000 | 1 |

7.

| Number of Letters | Frequency |
|---|---|
| 2 | 1 |
| 3 | 2 |
| 5 | 1 |
| 6 | 1 |

Median

Find the median for each of the following sets of data.

1.

| FAMILY SIZE | NUMBER OF FAMILIES |
|---|---|
| Less than 3 children | 7 |
| 3 children | 4 |
| 4 children | 3 |
| 5 children | 3 |
| More than 5 children | 4 |

2.

| QUIZ SCORE | FREQUENCY |
|---|---|
| 10 | 1 |
| 9 | 3 |
| 8 | 5 |
| 7 | 4 |
| 5 | 2 |
| 2 | 1 |

3.

| HEIGHT | NUMBER |
|---|---|
| 175 cm | 2 |
| 160 | 3 |
| 155 | 1 |
| 150 | 2 |
| 145 | 1 |

4.

| WEEKLY SALARIES | FREQUENCY |
|---|---|
| $300 | 1 |
| 250 | 1 |
| 175 | 3 |
| 125 | 8 |
| 100 | 2 |

5. a. Find the median score for each team below.

b. Which team had the higher median score?

| POINTS SCORED BY THE PLAYERS ON TEAM A | |
|---|---|
| April | 8 points |
| Audrey | 10 points |
| Eric | 9 points |
| Kate | 6 points |
| Maina | 8 points |
| Thalia | 6 points |
| Tom | 7 points |

| POINTS SCORED BY THE PLAYERS ON TEAM B | |
|---|---|
| Eseta | 5 points |
| Evans | 8 points |
| Hans | 6 points |
| Mary | 7 points |
| Obe | 10 points |
| Todd | 6 points |

6. Find the median age for the following set of data.

| AGES OF STUDENTS AT MANOA HIGH SCHOOL | |
|---|---|
| AGE | FREQUENCY |
| Over 18 years | 5 |
| 18 years | 2 |
| 17 years | 450 |
| 16 years | 423 |
| 15 years | 350 |

Sampling and Statistics Name_____

Median, Mode, Mean

Find the median for each of the following sets of data.

1.

| FAMILY SIZE | NUMBER OF FAMILIES |
|---|---|
| Less than 3 children | 7 |
| 3 children | 4 |
| 4 children | 3 |
| 5 children | 3 |
| More than 5 children | 4 |

2.

| QUIZ SCORE | FREQUENCY |
|---|---|
| 10 | 1 |
| 9 | 3 |
| 8 | 5 |
| 7 | 4 |
| 5 | 2 |
| 2 | 1 |

3.

| HEIGHT | NUMBER |
|---|---|
| 175 cm | 2 |
| 160 | 3 |
| 155 | 1 |
| 150 | 2 |
| 145 | 1 |

4.

| WEEKLY SALARIES | FREQUENCY |
|---|---|
| $300 | 1 |
| 250 | 1 |
| 175 | 3 |
| 125 | 8 |
| 100 | 2 |

5. a. Find the median score for each team below.

b. Which team had the higher median score?

| POINTS SCORED BY THE PLAYERS ON TEAM A | |
|---|---|
| April | 8 points |
| Audrey | 10 points |
| Eric | 9 points |
| Kate | 6 points |
| Maina | 8 points |
| Thalia | 6 points |
| Tom | 7 points |

| POINTS SCORED BY THE PLAYERS ON TEAM B | |
|---|---|
| Eseta | 5 points |
| Evans | 8 points |
| Hans | 6 points |
| Mary | 7 points |
| Obe | 10 points |
| Todd | 6 points |

6. Find the median age for the following set of data.

| AGES OF STUDENTS AT MANOA HIGH SCHOOL | |
|---|---|
| AGE | FREQUENCY |
| Over 18 years | 5 |
| 18 years | 2 |
| 17 years | 450 |
| 16 years | 423 |
| 15 years | 350 |

7. Find the mode for each of the seven sets of data above.

8. Find the mean for each of the seven sets of data above.

Sampling and Statistics

Name _____

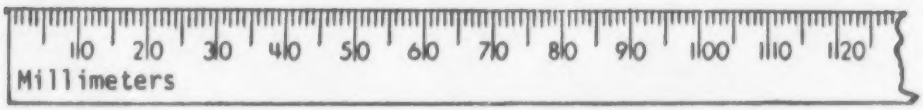
The Average

Date _____

1. Usually the first step in organizing data
2. The collection of data by using a questionnaire
3. The arithmetic average of a set of numbers
4. The organizing of data by tallying information in a table is called a _____ distribution
5. The middle value in a set of data that are ordered
6. A visual presentation of data
7. The number that appears most often in a set of numerical data

Metric

Transparency 1




3 cm = ____ mm

20 mm = ____ cm

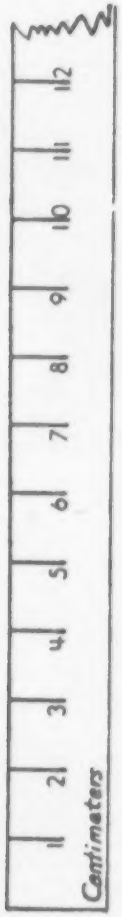
9 cm = ____ mm

55 mm = ____ cm

____ mm = 4.2 cm

____ mm = ____ cm

____ cm = ____ mm




ARE THERE ANY PATTERNS?

Metric

Transparency 2

# GUESS-TIMATE!

| | Estimate | Measure |
|---|---|---|
| 1. Height of door | _____ cm | _____ cm |
| | _____ m | _____ m |
| 2. Number of people at Hanauma Bay on October 29, 1979 | _____ | |
| 3. 519 x 7 | _____ | _____ |
| 4. 23.8 ÷ 2 | _____ | _____ |
| 5. Number of whales in world | _____ | |
| 6. Today's temperature | _____ °C | _____ °C |

Metric

Name _____

Worksheet 1

Date _____

# PIZZA PARTY

You are planning a pizza party. "Guess-timate" how much you should charge each student.

What you know:
30 students
large pizza costs about $8.95
6-pack of soda costs $1.79

Record your guesses:

1. Number of pieces in a large pizza. _____
2. Number of pieces for each student. _____
3. Number of large pizzas you should order. _____
4. Cost of large pizzas ordered. _____
5. Cans of coke for each student. _____
6. Cans of coke needed. _____
7. Number of 6-packs to order. _____
8. Cost of cokes ordered. _____
9. Your guess for the <u>total cost</u>. _____
10. How much will each student have to pay. _____

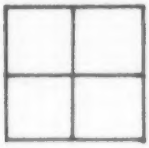
Metric

Name _____

Worksheet 2

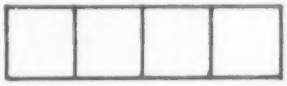
Date _____

1. Find the area and perimeter for each of the following polygons.

a. 

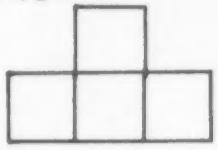
A = _____

P = _____

b. 

A = _____

P = _____

c. 

A = _____

P = _____

2. The polygons in exercise 1 are called Tetrominoes. Each one was formed by using four squares. There are two more Tetrominoes. Draw them and then find the area and perimeter of each one. (Each square should measure 1 cm x 1 cm.)

a.

A = _____

P = _____

b.

A = _____

P = _____

3. a. Draw all the polygons which can be formed using five 1 cm x 1 cm squares. These are called Pentominoes.

b. There are _____ Pentominoes.

c. The _____ of each Pentomino is the same; however, the _____ vary.

d. What is the measure of the largest perimeter for a Pentomino? _____

e. What is the measure of the smallest perimeter for a Pentomino? _____

# QUIZZES AND TESTS

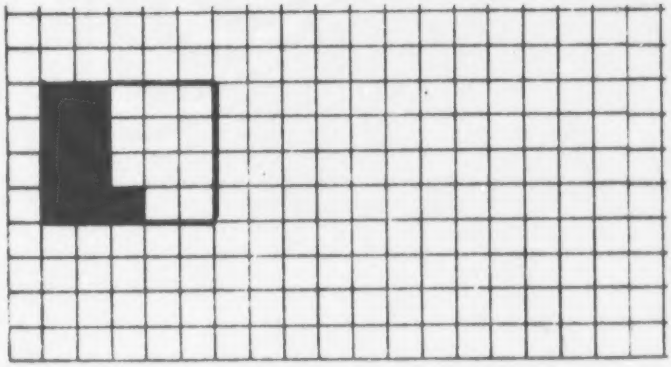
Sampling & Statistics

Name _____

Quiz 1

Date _____

1. Use the grid provided to show your work.



9 out of 20

_____ out of 100

so, $\frac{9}{20}$ = _____%

2. Who got the better score? _____

Ann: 18 correct out of 20 problems _____%

Barbara: 23 correct out of 25 problems _____%

3. Change $\frac{15}{60}$ to a percent. Show your work.

4. Round 59.515 to the nearest whole number.

5. Change $\frac{1}{18}$ to the nearest whole number percent.

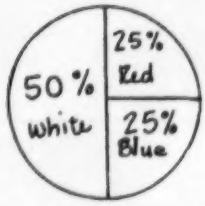
Sampling & Statistics Name _____

Quiz 2 Date _____

1. Write $\frac{3}{25}$ as a percent. _____

2. Write 4% as a ratio. _____

3. If you spin a pointer 100 times on the circle at the right, how many times do you expect it to stop on red? _____




4. A bag is filled with 200 pieces of candy. Some peppermint and some butterscotch. A sample of 25 is taken. There are 15 peppermint and 10 butterscotch. What percent of the sample are butterscotch?

5. A sample of 50 is taken from a bag of candy. 30% of the candy is chocolate. On the basis of this sample, how many out of the 250 pieces of candy in the bag do you expect to be chocolate?

6. Complete the following table:

| Favorite Color | Tally | Number | Ratio | Percent |
|---|---|---|---|---|
| Red | 𝍸 | | | |
| Green | 𝍸 \|\| | 7 | | |
| Orange | 𝍸 \|\|\|\| | | | |
| Blue | | | | |
| Total | | 25 | | |

Sampling and Statistics

Name_____

Quiz 3

Date_____

Fill in the blanks:

1. $\frac{13}{20} = \frac{\square}{100}$

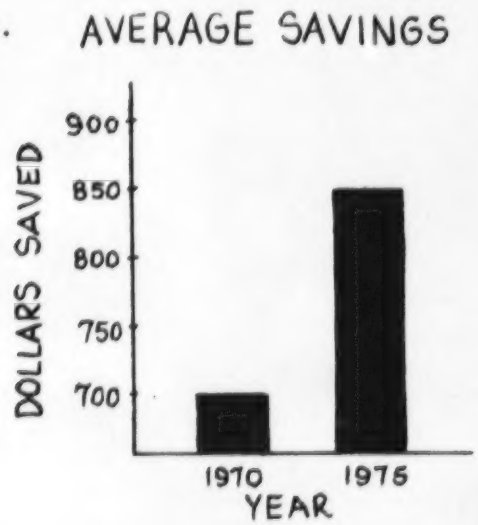
2. $\frac{8}{12} = \frac{\square}{3}$

3. $\frac{1}{3} =$ _____%

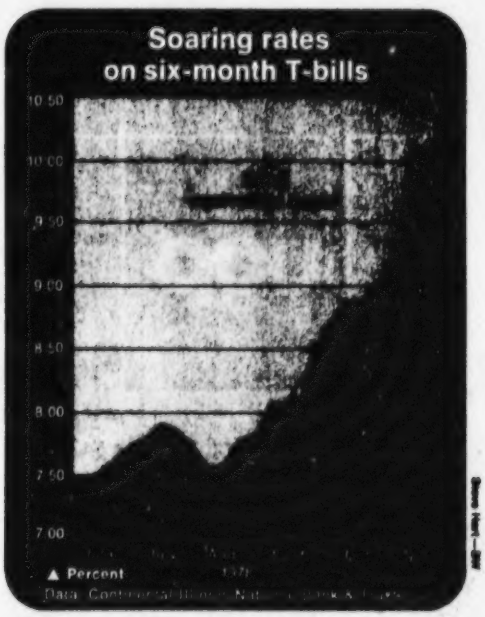
4. $\frac{15}{25} =$ _____%

Describe what is wrong with the graphs in problems 5 and 6 below:

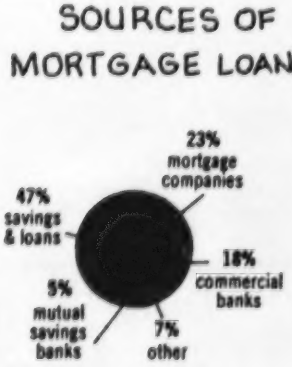
5.




6.




Use the graph below to answer questions 7 and 8:

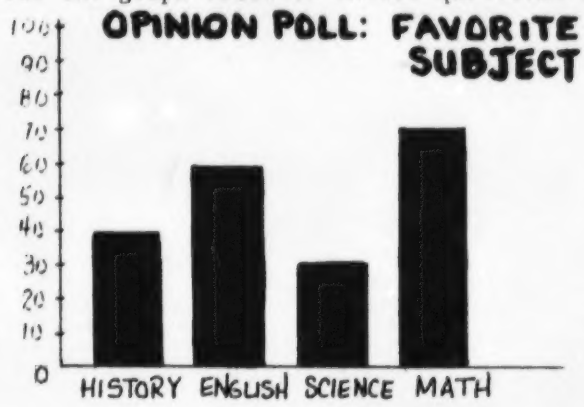



7. Which source provided the largest amount of mortgage loans?

8. If the total amount of mortgage loans was $12 million, how much of this did the commercial banks provide?

(Go on to the next page.)

Use the graph below to answer questions 9 - 11.



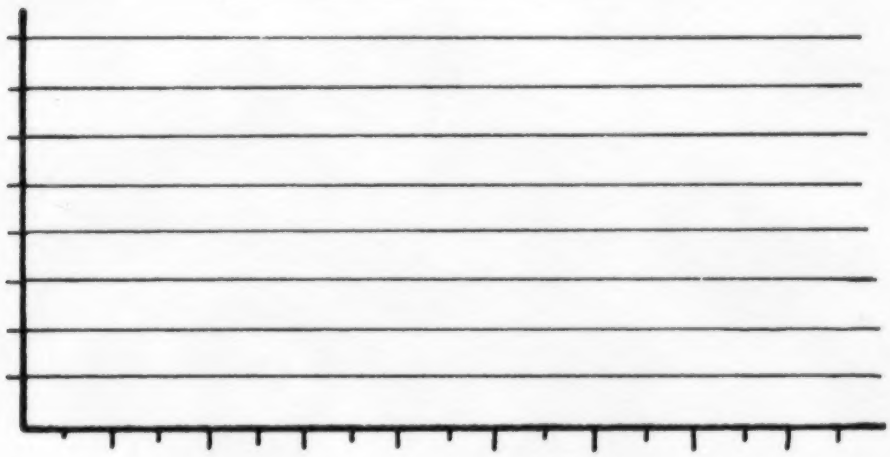

9. How many students preferred math?

10. What is the total number of students in this survey?

11. What percent preferred history?

12. Draw a bar graph using the information in the table below. Be sure to include all necessary detail.

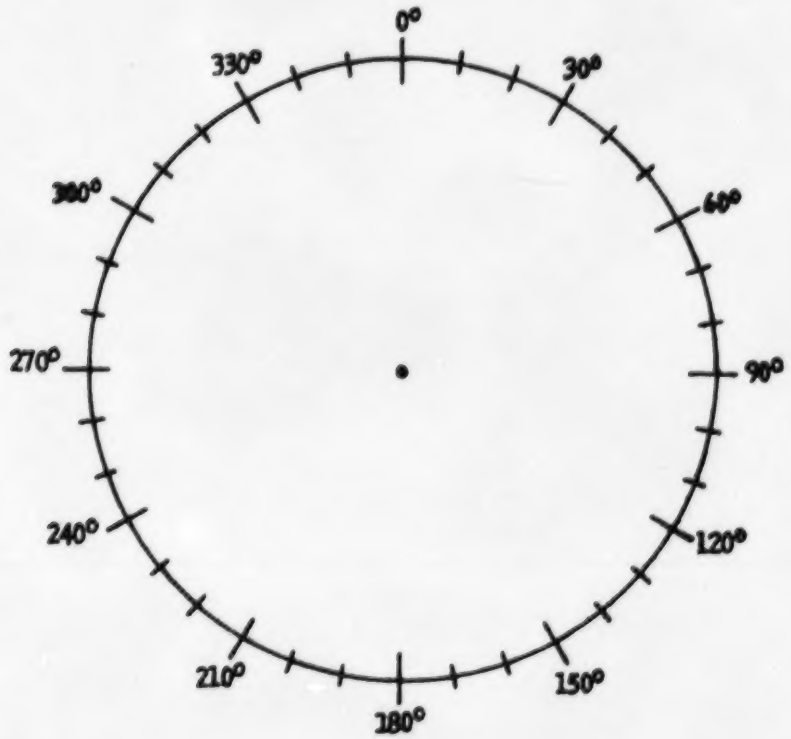
| VOTING RESULTS | |
|---|---|
| Project | Votes |
| Car Wash | 7 |
| Candy Sale | 6 |
| Magazine Sale | 6 |
| Huli Huli Chicken Sale | 3 |
| Calendar Sale | 2 |



(Go on to the next page.)

13. Draw a circle graph to represent the data for 1985 given below. Be sure to include all necessary detail.

| family income in 1971 dollars | percent of families 1985 |
|---|---|
| $25,000 or over | 19% |
| 15,000 to 25,000 | 34 |
| 10,000 to 15,000 | 20 |
| 4,000 to 10,000 | 20 |
| under 4,000 | 7 |



Sampling and Statistics

Quiz 4

Name _____

Date _____

Kakaako Elementary School has exactly 300 students. The enrollment by grades is shown on the table to the right.

KAKAAKO ELEMENTARY SCHOOL

| GRADE | NUMBER OF STUDENTS |
|---|---|
| Kindergarten | 35 |
| Grade 1 | 65 |
| Grade 2 | 70 |
| Grade 3 | 40 |
| Grade 4 | 30 |
| Grade 5 | 30 |
| Grade 6 | 30 |

For the data displayed in the table to the right:

_____ 1. Find the median enrollment.

_____ 2. Find the mode enrollment.

_____ 3. Find the mean enrollment.

_____ 4. What is the range?

Mrs. Tanner gave a 50-point test to her class of 20 students in mathematics. The results are recorded on the table to the right. Use this information to answer questions 5-10.

| TEST SCORE | FREQUENCY |
|---|---|
| 49 | 1 |
| 48 | 1 |
| 44 | 1 |
| 42 | 5 |
| 40 | 2 |
| 38 | 2 |
| 36 | 3 |
| 32 | 3 |
| 28 | 2 |
| Total | 20 |

_____ 5. What is the mode score?

_____ 6. What is the median score?

_____ 7. What is the mean score?

_____ 8. What is the range of scores?

_____ 9. What is the rank of a student who received a score of 42?

_____10. What is the percentile rank of a student who scored 38?

Sampling & Statistics Name _____

Unit Test Date _____

1. 9 out of 20 means _____ out of 100

2. $\frac{2}{3}$ = _____ %

3. $\frac{12}{15} = \frac{\square}{100}$

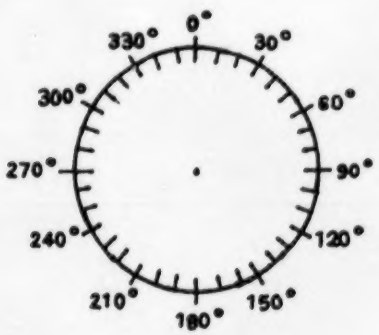
4. Write $\frac{1}{12}$ to the nearest whole number percent. _____

5. Write 2% as a ratio. _____

6. You have a box with 500 marbles. You take a sample of 100 marbles and find 25 red, 40 blue, and 35 white. How many blue marbles would you guess to be in the box of 500?

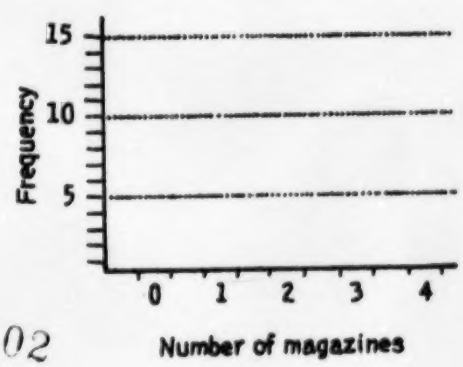
7. A deck of cards is 25% hearts. If you were dealt 15 cards, how many hearts would you expect to have?

8. Shade 35% of the circle below:




9. Thirty students tallied the number of magazine to which their families subscribed. Draw a bar graph of the data.

| Number of magazines | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Number of students | 14 | 7 | 4 | 3 | 2 |



10. What percent of the passes were attempted on a third down?

_____

11. If the ratios remain the same, how many passes out of a total of 100 would be attempted on a second down?

_____

| Down | Number of passes |
|---|---|
| First | 15 |
| Second | 25 |
| Third | 18 |
| Fourth | 2 |
| Total | 60 |

The number of stamps in a desk drawer is shown in table 1.

12. What is the total number of 8¢ stamps? _____

13. What is the ratio of 9¢ stamps to the total number of stamps? _____

14. What percent of the stamps are 10¢ stamps? _____

15. What is the mode stamp? _____

table 1

| Value of stamp | Tally | Frequency | Ratio | Percent |
|---|---|---|---|---|
| .10 | /// | 3 | $\frac{3}{30}$ | |
| .09 | 𝍸 | 5 | | |
| .08 | 𝍸 𝍸 / | | | |
| .07 | / | 1 | $\frac{1}{30}$ | 3% |
| .06 | 𝍸 / | 6 | $\frac{6}{30}$ | 20% |
| .05 | //// | 4 | $\frac{4}{30}$ | 13% |
| Total | | 30 | | 100% |

**Find the median**, mode(s) and mean for the following sets of numbers.

| | | Median | Mode(s) | Mean |
|---|---|---|---|---|
| 16. | 9, 9, 7, 6, 5, 5, 5, 5, 4, 3, 3, 2, 2 | _____ | _____ | _____ |
| 17. | 42, 18, 32, 18, 12, 28 | _____ | _____ | _____ |
| 18. | .07, .06, .06, .04, .04, .03 | _____ | _____ | _____ |

The results of 50 standardized tests are recorded in table 2. Use table 2 to answer exercises 19 - 24.

19. What is the mode score? _____

20. What is the median score? _____

21. What is the mean? _____

22. What is the range of scores? _____

23. What is the rank of a student who received a score of 91? _____

24. What is the percentile rank of a student who scored 80? _____

table 2

| Score | Frequency | Product |
|---|---|---|
| 94 | 1 | 94 |
| 92 | 1 | 92 |
| 91 | 3 | 273 |
| 88 | 2 | 176 |
| 87 | 3 | 261 |
| 85 | 4 | 340 |
| 83 | 5 | 415 |
| 80 | 5 | 400 |
| 78 | 7 | 546 |
| 76 | 6 | 456 |
| 75 | 5 | 375 |
| 72 | 5 | 360 |
| 71 | 2 | 142 |
| 70 | 1 | 70 |
| Total | 50 | 4000 |